ORIGINAL MEMOIRS.

PARATHYROID IMPLANTATION IN THE TREATMENT OF TETANIA PARATHYREOPRIVA.

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In spite of the amount of experimental work done in recent times on the functions of the parathyroid bodies and of the conclusions which this work seems to have established,—so far, at any rate, as their necessity to the bodily economy and the special results accruing from their removal or destruction are concerned,—a search up and down the reports of the meetings of surgical societies in this and other journals during, say, the past year will provide evidence of much skepticism on the subject in the minds of many surgeons. Moreover, in a recent book on the subject (Ochsner and Thompson), after an admirable account of experimental work done on the parathyroid bodies and a clear summing up of the conclusions reached, it is thought necessary to devote a section to the attitude of those unwilling to accept those conclusions. For this skepticism there are perhaps two reasons: one, the difficulty of apprehending the fact of such small and insignificant bodies being charged with such great importance to the health of the body; and the other, the rarity of human (clinical) instances clearly indicating the same facts concerning the parathyroids as have been arrived at by the experimentalists. This latter point,

it seems to me, sufficiently justifies the publication of the following case. If any further justification were needed, I would say, without in any way wishing to exonerate myself from the blame due to a faulty judgment, that it was owing to such skeptical utterances on the part of some prominent surgeons, that the present story is there to tell, with its disagreeable experiences to both my patient and myself.

The patient, a married woman twenty-four years of age, weight about seven and a half stone, came to me first about the middle of 1909. She presented a typical example of Graves's disease, in which all the main signs and symptoms were present. There was a large bilateral prominent goitre; exophthalmos was very marked and symmetrical. The pulse-rate at rest was 90 to 100 and went up to 130 and 140 on the least exertion or excitement. The patient was rather hoarse, owing to a small tumor growing on the front part of the right vocal cord. She was somewhat anæmic, and amenorrhœa had existed for some months; otherwise the history and condition presented nothing special. She had one child about two years old. For several months she was treated by medicine and rest without much improvement, so on October 13, 1909, I removed the right lobe of the thyroid under ether anæsthesia. There was nothing specially noteworthy about the operation. I divided all the vessels as close to their entrance into the gland as I could, but did not see anything of the parathyroid bodies. The adhesions posteriorly were rather beyond the average in strength and extent. The after-course of the case was smooth, the wound healed at once, there were no bad symptoms, and the patient returned to her home about a fortnight later.

Distinct improvement was the result of this operation, and menstruation became normal, yet it was obvious that there was far too much thyroid tissue left, so just six months later, on April 15, 1910, I undertook the second operation. I should say that just prior to this second operation, owing to certain skeptical utterances by leading surgeons in America and elsewhere, I had allowed myself to become imbued with a certain disregard for the parathyroids. This feeling I am certain will never revisit me so long as I live. It was owing to it, however, that at this

second operation I removed nearly all of the remaining thyroid, including, ultimately (though I had not at first intended it), the whole of the very large left lobe and most of the greatly enlarged isthmus. I left only a piece of the isthmus as big as a large walnut at its left lower portion. Extensive posterior adhesions again made the operation a little more troublesome than it sometimes is. Again the immediate after-course was as satisfactory as could be wished, healing took place *per primam*, and in spite of a short sharp rise of temperature on the second and third days the patient's general condition was quite satisfactory.

The operation was on April 15. On the nineteenth the nurse's notes mention " a feeling of stiffness in both hands and the left leg, with feeling as of pins and needles." This continued on and off, but was so slight and appeared to interfere so little with the patient's general comfort and well-being that not much notice was taken of it till the twenty-third, when in the early morning the discomfort became marked; by 10 A.M. the tendency to tetany was quite clear, and I realized the true nature of the trouble. I immediately put her on calcium lactate, ten grains every two hours. In the afternoon there was marked and painful tetany. Chloral hydrate was given (five grains hourly) and she got some relief after the third dose. Retention of urine occurred, making necessary the passage of the catheter during two days.

On April 24 I procured five ox parathyroids (from freshly slaughtered bullocks), made an emulsion from them by cutting them up and then thoroughly pounding them and mixing with normal salt solution. This, strained through gauze, I injected under the skin of the abdomen.

The note on April 26 is, " much better; hands a little stiff if moved." She continued better, and on May 5 left the private hospital to stay with some friends near by. Pulse and temperature are noted normal. I may say here that at the beginning of this tetany trouble, *i.e.*, from April 23 to 25, the temperature was raised, reaching as high as 102.2° F., but never afterwards during the course of her illness.

On May 7 (three days after leaving the private hospital), I received an urgent message, and found her in a terribly severe attack of tetany. The hands and arms were rigid, elbows bent slightly beyond right angles, wrists bent to the utmost extreme, metacarpophalangeal joints flexed as much as possible, fingers

straight and bunched together, thumb straight and drawn in below fingers. The description "obstetric position" of hand fairly applies. The lower limbs also were stiff and straight, the ankles especially being extended to the utmost. She was crying with pain and was a most pitiable sight to behold. She was given chloral hydrate (five grains hourly) and brought back to the private hospital. After three doses of the chloral, considerable relaxation of the stiffness and sleep were produced. Next day (May 8) she remained easier, but on the morning of the ninth an intensely severe attack of tetany occurred. Amyl nitrite was tried but had no effect. At 10 A.M. chloroform was administered in bed (on this and many other occasions it was noticed that chloroform did not tend to relax the tetany; it rather made it worse and sometimes seemed to bring it on when not previously present). She was taken to the operating room and an opening was made over and through the right rectus abdominis to provide a pocket between it and the subjacent transversalis fascia. Into this pocket was now slipped the whole thyroid excised liberally from the neck of a good-sized collie dog, which was ready under chloroform. The openings in muscle and skin were closed. In the evening another severe attack of tetany occurred, during which marked strabismus was noticed. After four doses of chloral (five grains hourly) the patient went to sleep and slept all night. The catheter was required, and nutrient enemata were given owing to the patient's weakness; but no more attacks of tetany occurred till the seventeenth, eight days after the implantation. On this date and next day several slighter attacks occurred, relieved by early administration of chloral. On the evening of the eighteenth, another emulsion made from two parathyroids, procured fresh at the slaughter yards, was injected. This was followed by greatly diminished stiffness and absence of any attack for some days, although her condition was very poor, the notes mentioning (after the twenty-second) occasionally "general stiffness, depression, and weakness; has to be fed."

On the morning of the thirtieth she seemed to be better, feeding herself; but at 4 P.M. she had what is described as the worst attack of tetany up till then. To try and relieve her terrible pain and distress I gave her chloroform, putting her quite deeply under its influence, but without producing the slightest relaxation of the muscles. After administrations of bromide of potassium (gr. xx)

and chloral (gr. xxx) by rectum she slept and had a good night. On the succeeding days she suffered much from stiffness and pain, though without any well-defined attack. On June 2, an emulsion was injected made from five dried parathyroids, which had been kindly procured for me by Dr. Bull, fresh at the Melbourne abattoirs and dried slowly at a low temperature. In contrast to all the administrations of fresh parathyroids, we could not notice any effect from this administration of the dried glands. On June 7 two parathyroids, taken directly from a living dog (under chloroform), were implanted through a small incision, under cocaine, under the left breast. This procured much relief, for some days scarcely any complaint was made, and the patient got up and walked about a little. On June 19 complaints are noted again of frequent transient feelings of stiffness and pain, together with burning feeling in feet and legs. She spoke a little thickly at times, the words running together. The beneficial effect of this implantation (of June 7) lasted till after the twenty-fourth; after this there were more complaints, and the notes say, " always some stiffness, chiefly of arms, but also legs and mouth muscles, also burning feeling in feet and legs." On June 29 one parathyroid (all that could be found) from a chloroformed dog was implanted beneath the left breast. According to the notes this did not seem greatly to benefit her condition.

On July 4 it is noted that there was complaint of twitching in hands and arms and of a tight feeling round heart. This latter was frequently complained of. In the evening of the fourth the hands were very stiff—relieved by chloral (gr. x). On July 8 the note is, " stiffness, burning sensations, no appetite, cramps increasing." On the tenth, " heart very troublesome, pulse small and irregular, difficulty in breathing; had an attack of stiffness, complained of spasm round heart." On July 12 an emulsion made from three parathyroids (bullocks') was injected. On the thirteenth she had a " fit " which I did not see, but which was thus described by the nurse in charge: " face blue, eyes fixed and open, pupils dilated, frothed at the mouth, skin clammy, urine passed involuntarily, unconsciousness complete; during fit, hands flexed backwards at right angles to arms " (the exact reverse of what usually occurred). The condition was only moderately good from the thirteenth to the nineteenth. She complained of cramps at times, but there was no suggestion of any attack of tetany.

On the seventeenth and again on the nineteenth she had doses of pituitary extract, without any obvious effect. On the nineteenth in the early morning she was seized once more with a typical and very severe attack of tetany; the pain was terrible—she wished to be put out of her misery. Two ox parathyroids kept at 32° F. from moment of removal from freshly slaughtered bullock were inserted beneath the breast under chloroform. After this she became much better again, was up, and complained very little till July 28. On this date it is noted, " stiff on waking; eyes felt stiff during day." On the twenty-ninth it is noted, " stiffness increasing." On this date I transplanted from a small monkey, which I had procured some days previously, the whole thyroid with certainly two and probably three of its parathyroids into a space prepared beneath the patient's left sternomastoid muscle.

From this time on there were no more of the definite attacks of tetany, and the patient on the whole was decidedly better. She was very weak and thin, and was troubled with successive small abscesses, two in the eyelids and one in the labium vulvæ. She often complained of pain round heart and burning feeling, chiefly in the legs, but the stiffness was noted as being less, certainly up to August 15. After this date there was more complaint of stiffness affecting arms and legs, also round eyes and mouth; of the burning sensations and the tightness about the heart. On August 26 a twitching of left arm was noted.

On August 27 an opportunity occurred which I had been long on the lookout for, by which I was able to secure for implantation the parathyroids of a human subject almost immediately after death. The donor was a man aged forty-nine, who died of Bright's disease and uræmia. I removed within half an hour after death three parathyroids and (separately) a piece of the thyroid as big as a small walnut, dropped them into normal salt solution at 32° F., and within an hour had implanted them beneath the left rectus abdominis of my patient. From this time on improvement, though slow, was steady and uninterrupted. From September 3 till the twelfth I find the following notes: " sitting up, taking food well, sleeping well; has slight attacks of stiffness lasting a few seconds; is outside most of the day; has tightness round heart occasionally, appearance has improved markedly, some stiffness of legs in walking."

On September 14 she was sent to her home 20 miles away; her weight was six and a half stone.

She called to see me again on October 26; she had gained 15 pounds in weight since the previous date and was very well indeed, with the exception of a certain degree of anæmia (70 per cent.); also that she had not yet menstruated since April. The eyes are still somewhat prominent.

The above account is compiled from the notes of the case carefully kept from day to day. I will now endeavor to give a short analytical résumé of its course, then discussing at greater length symptoms and remedies.

The thyroidectomy (second) was done on April 15.

On April 19, four days later, complained first of nerve symptoms,—stiffness of hands and pins and needles in left leg.

On April 23 had first attack of tetany.

On April 24 had first parathyroid emulsion; much better till May 7, when very bad tetany occurred, relieved by chloral but repeated on May 9—a very bad attack on this date; implantation of dog's thyroid with (presumably) one or more parathyroids; much better till May 17. On this and the next day several slighter attacks of tetany occurred.

May 18: parathyroid emulsion injected; better, and no attack of tetany till May 30, when there was a very severe attack.

June 2: emulsion made from dried parathyroids injected. No benefit noted.

June 7: implantation of two parathyroids from living dog. Great improvement for 12 days.

June 19 to June 29: return of symptoms, slight at first, increasing in severity.

June 29: one parathyroid transplanted from dog. Not much improvement. Less severe attacks of tetany on July 4, 8, and 10. Heart specially troublesome during this period.

July 12: parathyroid emulsion injected. " Fit " on July 13. Condition moderately good with no attacks till July 19, when there was another very bad attack of tetany. Implantation of two ox parathyroids preserved at freezing point.

Very great improvement till July 28 (11 days), when symptoms showed signs of returning.

July 29: transplantation of monkey's thyroid and parathyroids. Very little stiffness for 16 days—till August 15; from this date symptoms increasing again (but with no distinct attacks) till August 27, when human parathyroids were implanted. Steady improvement after this.[1]

From the above it will be seen that the distinctive symptoms of parathyreopriva first manifested themselves four days after the thyroidectomy,—which seems to be about the usual time,—though a distinct attack of tetany did not appear till four days later again. After this it appeared to us that the symptoms could be held in check for from 8 to 14 days, but no longer, by the subcutaneous administration (in one way or another) of parathyroid. The relief afforded by implantation (from dogs and oxen) seemed decidedly greater, both as to completeness and duration, than that gained from emulsions.

Now as to the various symptoms which manifested themselves during the progress of the case: The most striking one was, of course, the attacks of tetany, which I have referred to and in some measure described. These attacks never came on quite suddenly, but were ushered in by gradual increase of existing discomfort. They often lasted several hours with varying intensity, ultimately yielding apparently to chloral, the more readily if it were given early. Consciousness was never in the least degree affected by the attacks; but the pain

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[1] It will be noted that on several occasions thyroid as well as parathyroid was implanted. This was done, especially at first when I did not find it easy to pick out the parathyroids, as offering a quicker and easier method of transplanting at least some of the parathyroids from small animals, such as dogs, waiting under chloroform. Their small thyroids, excised rather widely and with the vessels cut long, were slipped entire into the pockets prepared for them. But, at the thyroidectomy, I had left less thyroid tissue than I usually do, and came to feel anxious lest on this account myxœdema should possibly be added ultimately to the other troubles. That was why, at the final (human) implantation, I took a small piece of thyroid as well as the parathyroids. This case, I think, presents sufficient evidence that it was the parathyroid, not the thyroid, treatment which benefited the patient. Moreover, thyroid feeding (by tabloids) was given a thorough trial without any result.

and anguish during them were terrible to witness. The arms were the most affected, always symmetrically, then also the lower limbs, and commonly the muscles about the mouth and about the eyes. The proptosis seemed worse and pain about the eyes was nearly always complained of. Also cramps at the heart were suffered, and sometimes on these occasions the pulse became, for a short time, weak and irregular. This heart participancy in some of the later attacks gave some anxiety about the immediate outcome.

Apart from these definite attacks of tetany, there were, during much of the time, certain lesser symptoms and signs present. These were mainly related to the definite seizures, the tendencies or conditions being less marked and more transient. For example, the hands when at rest, though not rigid, would fall naturally into the position which they took during the attack; there would be complaint of more or less stiffness. Burning sensations in the legs were common, as also was a " crampy feeling " about the heart. When these signs increased in severity, a definite attack of tetany was, as a rule, to be expected.

The temperature, except on two occasions already noted at the beginning of the illness, was normal throughout.

The pulse was commonly good, varying from 70 to 90— mostly near the lower limit.

The tongue was clean as a rule, and food was nearly always well taken.

The bowels were inclined to be constipated. Constipation with clay-colored motions was thought by one of those in close attendance on the case to result whenever calcium lactate was pushed. Emaciation was not very marked; weakness and anæmia (hæmoglobin down to 60 per cent.) were observed chiefly about the middle period of the illness.

The curious " fit " noted on July 13 was the only instance of unconsciousness, and as I did not see it, I cannot say much about it. Following immediately after a good dose of parathyroid emulsion I wondered at the time whether it could possibly be caused by too great or sudden absorption of this substance.

The Remedies Used.—Of all the various remedies tried, only two proved themselves of real value: chloral hydrate (and in a lesser degree chloretone) as a palliative for the attacks, and parathyroid.   With regard to chloral, the good we got from it was undeniable, though sometimes it would seem to fail us when the attacks were well under way before it was given.   Five grains half hourly or hourly would often seem to check or mitigate an oncoming attack.   Morphia (gr. $1/_6$) was given twice for the pain.

Pituitary extract was given three times, but did not seem to have any particular effect on the case.

Thyroid gland substance (Burrough's Wellcome tabloids) was given a fair trial, without any result.

Calcium has had great claims made for it in these cases, and according to the most recent pronouncements (Ochsner) is of the greatest value—is indeed able to take the place of parathyroid.   My experience in this case does not enable me in the slightest degree to endorse this opinion.   At the first onset of tetany it was given in doses of 10 grains (calcium lactate) hourly and two hourly.   This was kept up for some days; and later I returned to it several times, giving it most thorough opportunities of showing if it could help us.   It never seemed to do so in the least.

Aperients seemed of some little value, sometimes appearing to lessen the symptoms when constipation was present.

Parathyroid.—This was the one thing on which our experience taught us to rely with perfect confidence for lasting amelioration of the patient's condition.   It was not only in keeping off the definite attacks of tetany, but also in greatly mitigating the lesser, more constant troubles (which I have referred to above), and so in most markedly improving the patient's general condition and appearance, that parathyroid proved its value.   Emulsions did good, implantations were still better and longer lasting in their effect.

It really was wonderful to see, both to us and to the patient's friends, how a day or two after an implantation all troubles would subside, and the patient would be up and per-

haps walking about, cheerful and even merry. During such periods, until I came to realize their inevitably short duration, I could scarcely refrain from letting the patient go home.

But it soon became clear that to keep the patient thus comfortable, parathyroids would have to be procured and administered about once a fortnight at the outside. Now the procuring of fresh parathyroids, whether from bullocks or dogs, is not a convenient or enjoyable undertaking. Dr. Bull, of the Melbourne University, was kind enough at my request to procure some parathyroids from the Melbourne abattoirs, and to dry them carefully and send them to me. For some reason, however, they proved to be of no use—the only occasion on which parathyroid seemed to entirely fail us. At my earliest implantations I was unaware, while using the parathyroids of dogs or oxen for this purpose, that the cytolytic action of the body fluids on heterologous tissues implanted precluded any hope of permanent success. Later, though aware of this, I still transplanted from those animals because the implantations gave more marked and longer lasting results than the emulsion. It was Professor Osborne, of the Melbourne University, to whom I had applied for any help or guidance he could give me, who suggested the transplantation from a monkey. He thought that the much less remote kinship might possibly allow the transplanted organs to survive, and I am inclined to think his idea a correct one; that the monkey's parathyroids did actually survive longer than those of the oxen and dogs, and might indeed, unaided, have conferred some permanent benefit on the patient. (The monkey, I may say, recovered from its operation, was well for a week, then died three days later from a form of paralysis, after showing some signs of tetany. The wound was soundly healed.) But the chance for human transplantation seemed too good to be lost—offering, as I believed it did, a still stronger hope of happily terminating a most distressing case. Here again I was helped by learning from Professor Osborne that the vitality of removed organs might best be prolonged by putting them at once in salt solution at 32° F. I may say

that, as regards all the implantations, healing was perfect; no suppuration ever occurred.

From the first I made endeavors to procure some parathyroid extract, which I know has been on the market both in Europe and America. Vassale, for instance, worked out a special method of manufacturing it, and by its aid claims to have benefited cases of medical tetany, rickets, and some other diseases. But the Melbourne chemists and their London agents were quite unable to procure any of it. The use of such extracts seems, however, from recorded cases to have been more often disappointing than valuable in cases of tetania parathyreopriva.

What does this case prove? I think it may be modestly claimed that it proves, what, pace the skeptics, was really in no need of proving, that removal of the parathyroids brings about a morbid condition, of which attacks of tetany are one of the most striking manifestations. Also that no remedy, of those I used, really ameliorates this condition, except the administration, in some way, of parathyroid. Is there any hope of the permanent cure of this morbid condition apart from the successful implantation—successful in the sense of their permanent reception and life and growth as part of the body—of parathyroids from another body? I think that the present case as well as the general body of evidence on the subject gives little foundation for any such hope. Haberfeld and Schilder in very recent work, whose main result was to show that accessory parathyroids may exist in the thymus gland, found in three instances (in rabbits) where they gradually, at intervals, removed, as they considered, every bit of parathyroid tissue, that the animals ultimately recovered. This they take to show that the very gradual withdrawal of all parathyroid tissue from the body is not necessarily fatal. This is the only bit of evidence I have been able to find that the body can ever adapt itself to do without the parathyroids. Some results of Kocher seemed to show that the successful implantation of thyroid tissue held the parathyreoprivic symptoms in check; but this experience seems to be at variance with

most experimental results.   And the wonder is natural whether the thyroid tissue transplanted did not contain some parathyroid tissue.

Experiments point unmistakably towards the probability of the parathyroids being indispensable to health.   A most vivid example is one of Halsted's experiments, where cachexia parathyreopriva, having been artificially produced, was cured by a successful implantation of one parathyroid in a dog.   Some time later this body was dissected out, with the result that the dog died in tetany within 24 hours (Ochsner and Thompson). On the human or clinical side, Ochsner, having earlier conceded great value to calcium—a concession which the history of the present case does not justify—yet sums up the whole matter by asserting that the parathyroid bodies are essential to life and that their loss can only be made good by their reinstatement, *i.e.,* successful implantation.   In my own case, I believe that the implantation of the monkey parathyroids was the first measure which with any permanence put the patient in a better condition.   Possibly the benefit might have been lasting; though one would have much liked to settle that question, I could not resist the opportunity of implanting the human glands.

I would like to acknowledge my indebtedness to Dr. Bull and to Professor Osborne, both of the Melbourne University, for assistance in this case.   To the helpful suggestions of the latter I really feel that I owe no small part of the ultimate success.

GASTROSTOMY AS A CURATIVE MEASURE PER SE IN NON-MALIGNANT STRICTURES OF THE ŒSOPHAGUS.

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Twelve years ago, at a meeting of the Berlin Medical Society, some surprising remarks concerning the direct effects of gastrostomy upon cicatricial œsophageal stenosis were made by Professor Ewald.[1] In discussing a report of successful dilatation of a diphtheritic stricture by Rosenheim, he referred to a peculiar observation, which he had made in dealing with such benign stenoses, namely, the remarkable circumstance that cicatricial stricture, for which gastrostomy had been made, nearly always improved steadily after the stomach fistula had been provided and food had been introduced through the fistula instead of through the gullet—that is, the strictures gradually developed a larger calibre without any other treatment whatsoever.

He found that his patients who previously could get only a small amount of fluid through the stenosis began to take more solid foods, and finally were able to eat and swallow almost as they did before the appearance of the stricture. He observed further that, after the gastrostomy, sounds could be passed through a previously impassable œsophagus.

Ewald explained these phenomena in the following manner: After the gastrostomy is made it becomes possible to fill the stomach with food. The pull of the full stomach downward gradually stretches to some degree the elastic œsophagus. Now it is fair to assume that such stretching of the gullet lengthwise would not enlarge the lumen of the tube, but, on the other hand, tend to narrow it. This is true, but, in Ewald's judgment, true only so long as the stomach is full. When the stomach becomes empty the downward pull ceases. Then the pressure of the food mass above the stricture has its effect upon the stretched and more yielding strictured segment.

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More compact masses of food may then squeeze through, the food bolus itself acting as a bougie and gradually dilating the narrowed lumen.

Ewald reported two cases in which he had made these instructive observations. In both cases the stenosis had developed upon the basis of œsophageal ulcers, and in each case the passage of sounds in Ewald's hands had become impossible.

I am sure that similar unrecorded observations have been made by many others after gastrostomy in benign œsophageal stenosis. I have had in similar cases experiences precisely similar to those of Professor Ewald.

The explanation of the phenomena given by Ewald, however, can hardly be applied to all cases. I do not assume that he meant it to apply to all cases. After the swallowing of a hot or caustic fluid, the mucosa of the gullet may become deformed in many ways. Among many interesting deforming processes are, for example, the complete tube-cast-like separation of the mucous membrane described by Strauss, of Senator's clinic,[2] the œsophagitis dessicans superficialis of Rosenberg,[3] and œsophagitis exfoliativa.[4] In these conditions after the mucosa has become loosened from the underlying tissues and thrown into folds or ridges or pockets, it is easy to understand that the passage of food or of a bougie must be attended with great mechanical difficulty. It also seems fair to believe that the downward traction due to the filled stomach must have the effect, in some instances at any rate, of smoothing the valve-like folds and irregularities of the loosened membrane, thus permitting the passage of food through a previously impassable œsophageal lumen.

It is well understood that the arrest of food above an œsophageal stricture, with plugging of the tube, followed by the futile attempts at contraction and subsequent relaxation of the muscularis, produces in a large percentage of cases a sac-like or fusiform dilatation above the stenosis.*

In such sac-like dilatations, the opening into the stricture

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* This reference, of course, does not in any way apply to diverticula, but relates only to the sac-like dilatations unassociated with hernial protrusion of the mucosa through a defect in the muscularis.

below may not occupy a position at the most dependent portion of the sac, the sac sometimes bearing a relation to the gullet like that borne by the crop of a fowl. It is in cases of this kind that traction of the full stomach has occasionally proven a helpful factor, and although it may be somewhat suppositional, it can hardly be called unreasonable to conclude that this is due to the downward traction stretching the sac in such a way as to bring the opening into the strictured segment to a lower point; it being assumed that the tendency of the downward pull is to funnel the sacculation.

Such an effect would be possible only before the œsophagus had become quite tough and thickened by scar formation. The elasticity of the œsophagus in the normal state and in the early stages of stricture must be quite well understood by any surgeon who has attempted to remove a foreign body firmly lodged in the gullet wall with œsophageal forceps. I have pulled such a foreign body lodged at the crossing of the bronchus almost to the level of the cricoid cartilage and pushed it downward very nearly to the cardia, and yet it was not dislodged from the site at which it was imbedded in the œsophageal coats. Such quite common observations as this give evidence of the mobility and elasticity of the gullet. Stretching the elastic œsophagus by the pull of the full stomach tends to smooth out the folds and wrinkles, and facilitates the introduction of the bougie and the passage of food.

Gastrostomy is curative *per se* for another and more important reason. The rest afforded the œsophagus is of the greatest value in allaying the inflammation which precedes or attends practically all benign strictures. This curative influence of gastrostomy has been mentioned by Helferich,[5] Rosenheim,[6] Maylard,[7] Barozzi,[8] and many others, and has, no doubt, been noted by every surgeon who has made gastrostomy for stricture of the œsophagus. Nevertheless, the value of gastrostomy as a curative procedure *per se* because of the effect of the rest which it affords the inflamed œsophagus is hardly appreciated. In benign stricture of the œsophagus, one can often find evidences of inflammation in every stage,

particularly in the earlier cases of stricture. Soft infiltrations, or harder infiltrations in which are found but few plasma cells and a relatively small proportion of young connective tissue, will, if we are correct in our elementary and established conceptions of inflammation, yield or disappear if rest be provided. Certainly if ulceration be present the passage of food, or what is worse the arrest of food with consequent fermentation, must maintain or increase the activity of the ulcerative process.

The directly beneficial effects of gastrostomy in cases of so-called benign strictures of the œsophagus are not generally recognized nor appreciated.

We have been slow in discarding old estimates, which were developed in the pre-aseptic era when the performance of gastrostomy was attended with considerable danger.

Not a few earnest and progressive surgeons, in dealing with benign œsophageal stricture, think only of gastrostomy when starvation is imminent and the hand of death is upon the patient. Others, like Lejars[9] and Jacobson,[10] advise strongly against waiting until the hunger death is near before this purposeful and dangerless means of relief is grasped.

Twenty years ago Jacobson said, "that the comparison of treatment by gastrostomy and dilatation can hardly be made, because the former operation has, in such a large number of cases, been performed under most unfavorable conditions. Much too often it has been put off till the patient, scarcely able to swallow liquids, is just kept alive by enemata. Such patients, worn out by the miseries of slow starvation, often with secondary disease and lung and pleural complications, are not in a condition to be submitted to abdominal section, and are not likely to respond to the call made upon their vitality to unite two serous surfaces firmly together, on which depends the success of the operation."

Gottstein[11] and Dean[12] are representative of a large class of surgeons who believe that, as an operation of expediency, gastrostomy is not to be recommended, and reserve it as an operation of necessity to prevent starvation.

Rules laid down twenty years ago to govern the choice between gastrostomy and dilatation are misleading. Gastrostomy is so simple and safe that it should not be put off until the patient is scarcely able to swallow liquids and is being kept alive by enemata.

In reading the reports of cases of this kind occurring in the practice of others and observing my own cases, I have frequently been reminded that in those instances in which sounding has been greatly beneficial a gastrostomy had preceded.

Maylard, who says that gastrostomy in stricture is only palliative, makes a significant statement when he adds that the rest given may admit of dilatation being subsequently effective; and Cheyne,[13] who observes that " when a patient suffering from extensive and impassable stricture is unable to take sufficient food to support life and is brought almost to the verge of starvation, gastrostomy is called for to avert impending death," adds the following instructive paragraph: " It will often be found that the rest given to the œsophagus by the artificial opening into the stomach produces considerable improvement in the stricture, and not infrequently the patient can swallow far better than he could before within as short a time as a fortnight after the operation. This is probably due to the diminution of congestion and spasm given by the rest."

As a summary the directly beneficial effects of gastrostomy upon cicatricial œsophageal stenosis may be arranged as follows:

1. Gastrostomy renders unnecessary the introduction of irritating and fermentable foods into the inflamed or eroded œsophagus, thus influencing favorably the infiltrated gullet wall.

2. Stretching of the œsophagus by the pull of the filled stomach renders more yielding the strictured segment and makes possible dilatation of the stricture by food masses taken by the mouth (Ewald).

3. In the case of valve-like folds and deformities of the mucosa, sacculations and angulations of the œsophageal

lumen, the downward traction of the loaded stomach tends to smooth out these irregularities.

These are curative factors which pertain directly to gastrostomy.

Gastrostomy indirectly favors the relief of benign œsophageal strictures by providing a gastric fistula for the maintenance of nutrition while dilatation of the stricture or other direct treatment, as tubage or cutting, is being carried out, and by providing an avenue for retrograde dilatation or for the practice of Abbe's string saw, Ochsner's doubled catheter, Dunham's bow string technic, etc. In the latter relation to benign stenosis, gastrostomy has an established position, but as a curative measure in itself it deserves interested attention. By this it is not meant that gastrostomy alone will cure benign stricture of the œsophagus. It will, however, influence favorably the course of the process in an unappreciated degree. If an early gastrostomy is useful in malignant, syphilitic, and tuberculous stenosis, early gastrostomy is applicable in cicatricial stenosis for the same fundamental reasons.

In benign stenosis, so long as pulpy, semisolid, or even a portion of solid food can be swallowed, dilatation or tubage should be practised, but when the point is reached where the patient can only swallow liquids, we are slavishly following the teachings of pre-aseptic writers if we do not perform gastrostomy, not only because of its indirect usefulness, but also because of curative value *per se*.

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OPERATIVE TREATMENT OF WOUNDS OF THE HEART.

WITH REPORT OF A RECENT CASE OF BULLET WOUND OF THE HEART, LUNG, AND LIVER.

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THE reported cases of wounds of the heart show that 71 cases have been successfully sutured, while 106 have been operated upon with fatal result; 11 of the recoveries and 13 of the failures were cases of bullet wound. As the operation is still in a comparatively new field of surgery, and is looked upon as a considerable achievement, it is probable that a large proportion of the successful results have been reported. If, however, some of the failures have not been reported, the mortality of 60 per cent. which the above cases show may be an unduly low one.

From time to time since 1897 cases have been collected and arranged for the purpose of drawing conclusions concerning diagnosis, indications for operation, technic, and after-treatment (Rehn, Wendel, Salomoni, Vaughan, Peck, Grisogono).

The fact that 177 cases have been reported by 134 operators shows that no one individual has had a sufficient number of cases to be regarded as an authority in diagnosis and treatment; and as the infrequency of the injury itself may preclude the possibility of large individual statistics, conclusions must be based upon the study of the various observations. The publication of the following case, therefore, seems justifiable:

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CASE I.—The patient was admitted to the Frost Hospital, Chelsea, Massachusetts, on November 17, 1909, on the service of Dr. George Fenwick. He recognized the possibility of operative treatment for wound of the heart, and asked Dr. Brewster to see the case in consultation. The following account of the patient's condition previous to operation is taken from the records and examination made by Dr. Fenwick.

W. K., male, twenty-eight, Russian, in attempting suicide shot himself in the chest.

Physical Examination.—A well-developed and nourished man with symptoms of profound shock. Pallor was marked, the skin was cold and clammy, and the respirations were rapid. No pulse could be felt at the wrist. There was a marked alcoholic odor to the breath.

Over the fifth rib on the left side directly inside the nipple line there was a punctured wound with ragged edges, one-quarter inch in diameter. The surrounding skin within a radius of three-quarters inch was blackened, and outside this area were patches of red and white glistening skin. Heart sounds were indistinct. No cardiac dulness could be made out to the right of the sternum, and the left border of the heart could not be defined. Right chest normal. On the left side there was dulness in the back and axilla, with absence of respiration in the same region. Breath sounds could be heard, however, in the upper and anterior portion of the left chest. The dulness shifted with change of position. No râles were to be heard. The palpation of the abdomen was negative.

As a result of rest in bed and application of heat and salt solution infusion, the patient recovered somewhat from deep shock. The radial pulse became palpable and of fair character. The rate of pulse and respiration increased gradually. Flatness developed over the area of dulness in the left chest, and a few râles appeared in the upper portion of the left lung. No evidences of pericardial effusion could be made out.

The heart sounds became fainter and were heard loudest at the junction of the fifth costal cartilage and the sternum. There had been a slight but persistent oozing of blood from the wound, which seemed to be more constant than could be accounted for by the external wound alone.

It was six hours after the injury when we first examined the

patient. He was unconscious and almost moribund. Rigidity
and tenderness were now present in the upper abdomen. There
was flatness over the lower half of the left chest, which pointed
with almost certainty to an accumulation of blood in the pleural
cavity. The picture was that of concealed hemorrhage, and
operation seemed to offer the only chance of recovery.

Operation.—After hasty preparation, ether was administered,
causing some increase of hemorrhage from the point of entrance.
The external wound was then examined, and exploration of the
path of the bullet through the chest wall showed no lesion suffi-
cient to account for the hemorrhage. For this reason it was decided
to explore the pleural cavity.

An intercostal incision five inches long was now made over
the fifth intercostal space, ending at the sternal border, and the
pleural cavity opened. Respirations now became more rapid.
The lower edge of the upper lobe of the lung was blown forcibly
through the intercostal opening at each forced respiration, accom-
panied by a profuse gush of blood from the pleural cavity.
Respirations became somewhat dyspnœic. The presenting lobe
was seized with a clamp and drawn through the opening, thus
plugging the wound. To prevent further effects of pneumo-
thorax a tube leading from a tank of oxygen was inserted into the
right nostril. The lips were compressed and the left nostril
intermittently closed at inspiration and partly opened at expira-
tion. The edges of the incision were now retracted and the lung
remained in a state of two-thirds inflation from the stream of
oxygen. Dyspnœa did not recur.

Inspection of the thoracic cavity showed that its lower half
was filled with blood. A small wound noted in that portion of the
lower lobe overlying the cardiac area was not bleeding sufficiently
to account for the hæmothorax. A small stream of blood oozing
from the cardiac region led to the discovery of a round hole in
the left lateral surface of the pericardium. The costal cartilages
of the third, fourth, and fifth ribs were now divided and the third
intercostal space incised, making a bone flap which was reflected
outward. The opening in the pericardium was enlarged with
scissors and the heart delivered, exposing a round hole in the
anterior wall of the left ventricle. With the heart held in the
palm of the hand three catgut sutures were placed in the ventricle
wall. During this time blood spurted from the hole in the ven-
tricle at each contraction of the heart.

After the manipulation of placing the sutures, the hemorrhage steadily increased and it was necessary to make a second closure. A considerable amount of blood had been lost in the interval. The final suture was an over-and-over continuous catgut, which seemed to be more efficient than the interrupted sutures which had been applied first. This may have been due to the fact that the tension extended over a larger area of heart muscle. During the introduction of the last suture manual compression of the vessels at the base of the heart was found to control the loss of blood. During the time of the compression the heart contractions became very rapid and weak; while on relief of the pressure there was a noticeable improvement in the heart action.

Although the hemorrhage was completely checked by the final suture, the contractions soon became so feeble that heart massage was necessary to maintain the heart-beat until the opening in the pericardium had been closed. At this moment the contractions became fibrillary in character and soon ceased entirely, at which moment the operation was abandoned.

The following is an abstract from the autopsy report by George B. McGrath, Medical Examiner for Suffolk County, Massachusetts:

The front wall of the chest is opened by a surgical incision in the second intercostal space, beginning near the anterior axillary line, continued forward and downward across the costal cartilages of the third and fourth ribs close to the sternum, thence outward through the fourth intercostal space to a point near the midaxillary line, the incision corresponding in a general way with that on the outer surface of the body. The fifth rib, at a point 3.5 inches from the middle line and at its junction with the costal cartilage, shows an oval, ragged wound about 0.2 in. across, extending through it; the surrounding muscles contain a little sooty substance. Reflection of the divided ribs shows the opened pericardial sac and the exposed outer border of the left ventricle, upon which is a ragged wound closed by several sutures.

Thorax.—Height of diaphragm fourth rib on right side, on the left indeterminate.

Pleural Cavities.—Left: contains 500 c.c. of firm, currant-jelly-like clot; the left lung collapsed; the inner surface of the lower lobe on its lower border shows a laceration about 1.5 inches across; the lower surface of the lobe close to its lower border and near its inner surface shows an oval, lacerated wound 0.2 x 0.4 inch, immediately opposite which on the posterior and inner surface of the lobe is a similar wound of the same size; the mesial surface of the parietal pleura close to the diaphragm shows an oval wound about 0.3 inch in diameter, surrounded by a region of sub-

pleural hemorrhage about 1.5 inches across; the pleural surface of the diaphragm immediately opposite this point and 0.7 inch to the left of the pleuropericardial fold shows a superficial laceration, oval, 0.2 x 0.3 inch, the surrounding pleura a little blood-stained. The mesial surface at a point close to the spinal column, about 1.3 inches behind the aorta and near the ninth intercostal space, shows an oval, lacerated wound, 0.3 x 0.5 inch, the surrounding pleura a little blood-stained; at a point 0.1 to 0.5 inch behind this is a similar laceration 0.3 x 0.6 inch.

Right: traversed by old fibrous adhesions at the apex; contains about 200 c.c. of blood-stained fluid.

Pericardial Cavity.—The pericardium opened along its left-hand border by a surgical incised wound running nearly its entire length; the cavity contains 50 c.c. of currant-jelly-like clot; the left-hand wall of the pericardium at a point 0.5 inch from its reflection upon the diaphragm shows the perforating wound above described. *A probe introduced into the wound of the rib above described and passed successively through the wounds of the wall of the left ventricle of the heart, the pericardium, the diaphragm, the left lobe of the liver, the diaphragm, the lower lobe of the left lung, and the inner wall of the left pleural cavity, occupies a position nearly horizontal and at an angle of about thirty degrees with the sagittal plane from the left backwards and inwards.*

The venæ cavæ and pulmonary veins on section yield a small amount of red, post-mortem clot.

Heart.—Weight, 380 Gm.; epicardial fat fairly abundant; the wall of the left ventricle at a point 1.5 inches (3.5 cm.) from the apex shows a ragged, lacerated wound about 0.8 inch (2 cm.) in diameter closed by sutures; the posterior surface of the wall at a distance of 1.8 inches (4.5 cm.) from the apex and 0.6 inch (1.5 cm.) from the left-hand border shows an oval, lacerated wound about 0.8 x 0.5 inch (1.8 x 1.2 cm.). Upon section the cavities of both sides contain a very little post-mortem clot; myocardium light brownish red and fairly firm. The wall of the left ventricle at the site of the sutured wound shows extensive laceration penetrating to the cavity of the ventricle; the wound upon the posterior surface is continuous with this laceration through the substance of the myocardium, the wound extending obliquely from before backwards. The trabeculæ of the right ventricle prominent. The endocardium shows some post-mortem blood-staining; the valves and cavities normal. Coronary arteries normal.

Lungs.—Left: apex normal; slaty gray; collapsed; incompressible; flabby; the lower lobe shows the wounds above noted, that near the lower border perforating; in addition to these wounds the upper lobe on its front and lower border shows a small laceration about 0.3 inch across, the surrounding pleura blood-stained; this wound in the natural position of the lung overlies the wounds at the base of the lower lobe. Upon section grayish red, fleshy, under pressure yielding a moderate amount of blood-stained watery fluid; the bronchi empty; the bronchial mucosa dark red.

Right: apex normal, the front grayish red, the back bluish red; fairly

crepitant throughout; the pleura without markings. Upon section dark grayish red and wet, yielding abundant bloody froth.

Abdomen.—Peritoneal cavity (continued); between the left lobe of the liver, the stomach, and about the spleen is a small amount of red clot; the upper surface of the left lobe of the liver at a point 1.3 inches (3.2 cm.) from the middle line and a like distance from its attachment to the diaphragm shows an oval, lacerated wound about 0.2 x 0.3 (0.50 x 0.75 cm.) surrounded by a zone of blood-staining; the under surface of this lobe close to its posterior border shows a stellate, lacerated wound, the opened portion of which is 0.5 cm. across, lines of fracture radiating from it; the wound contains a little blood-clot. The peritoneum of the front and upper portion of the stomach (cardia) shows a superficial laceration about 1 inch across, the surrounding peritoneum blood-stained within a region about 4 inches across; continuous with this laceration is a ragged wound of the tissues between the diaphragm, continued into the second of the wounds in the latter above described.

Stomach.—Contains 500 c.c. of brownish, soup-like material without significant odor, in which are fragments of undigested meat; the mucosa of the cardia shows mottled bluish red discoloration, at a point opposite the laceration of the peritoneum above noted presenting a superficial tear about 0.5 x 0.1 inch (1.25 x 0.25 cm.); the mucosa in general yellowish gray and lustrous, that of the lesser curvature mottled with small punctate hemorrhages.

Liver.—Weight, 1790 Gm.; light yellowish brown; surface presents a faint "grain leather" appearance; the left lobe in its posterior border shows the wound above described. Upon section of similar color; muddy; consistence somewhat diminished.

Dissection in the region of the wound on the inner wall of the left pleural cavity shows opposite the intervertebral disk a ragged wound penetrating the upper border of the tenth rib close to its articulation; lying upon the fragmented border of the rib at a point about 1 inch from the median line is a leaden slug 0.7 cm. in diameter, point outward, the base slightly flattened, imbedded in the intercostal muscle.

(NOTE.—From a study of the wounds above described, it appears that the bullet, entering the front wall of the left side of the chest near the nipple line, penetrating the skin, subcutaneous tissues, the fifth rib, the pericardium, passed through the wall of the left ventricle obliquely from before backwards, opening the cavity of the ventricle, passed outward, penetrating the diaphragm, passed through the left lobe of the liver close to its posterior border, again penetrating the diaphragm passed through the lower lobe of the left lung, passed out of the left pleural cavity through a wound in the ninth intercostal space, becoming embedded in the inter-costal muscles close to the upper border of the tenth rib, its direction from before backwards towards the middle line at an angle of about 30 degrees with the sagittal plane and in a plane with the horizontal.)

While the technic of the operation was faulty in many respects, we became convinced that the exposure of the cardiac

area is not a difficult surgical procedure, and that the heart possesses a surprising resistance to the trauma of manual and instrumental manipulation. The hemorrhage of the six hours previous to operation and the blood loss resulting from faulty technic and a tearing out of sutures were doubtless the leading factors which contributed to the fatal result.

FIG. 1.
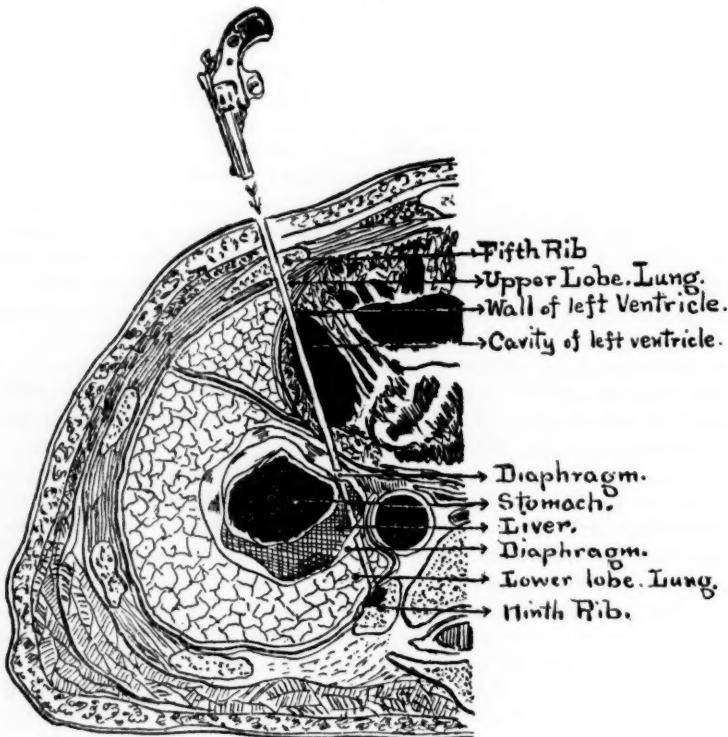
Diagramatic drawing of cross section of left thorax including the dome of the diaphragm, to show structures traversed by the course of the bullet.

The following discussion of the symptomatology, indications for operation, and treatment of such injuries is based upon the above experience, and upon the study of a large number of cases reported by other writers.

Diagnosis of Heart Wounds.—The existence of a wound in the heart is frequently suspected though not confirmed

except by operation or autopsy. With rare exceptions a definite diagnosis is quite impossible. Heart injuries are so commonly associated with wounds in the lung and pleura, that although the latter may be diagnosed, uncertainty invariably exists as to the heart involvement.

A small proportion of stab and bullet wounds of the chest is confined to the heart, and such cases are most liable to correct diagnosis. Hemorrhage is confined to the pericardium and the anterior mediastinum. As the hemorrhage increases, the pericardial opening sometimes becomes occluded and the condition known as " heart tamponade " arises. As the intrapericardial tension increases and the heart labors against it, a group of symptoms develop which are almost pathognomonic of the condition. Pain in the arm, a sense of constriction of the heart, dyspnœa, profound shock, and cold sweat are characteristic. A whirring sound in the cardiac region occurs infrequently. Several operators have in common discovered a symptom which is not noted by others, namely, absence of radial pulse in the left wrist, accompanied by a weak and scarcely palpable pulse in the right wrist (Fischer, Borzymowski, Tscherniachowski). Luxembourg lays emphasis on the feature that in the presence of heart tamponade the symptoms of air-hunger, dyspnœa, and pain, while distressing in the recumbent position, are relieved by a sitting posture. Auscultation and percussion invariably reveal an enlargement of the heart area, which is further demonstrated by the radiograph. If this enlarged heart shadow is in the line of the point of entrance and exit of a bullet, or coincides with that area towards which the canal of entrance of a stab wound is pointing, further evidence of hæmopericardium is provided.

As this condition of hæmopericardium continues, the right side of the heart is compressed, the blood from the large veins ceases to enter the auricles, the ventricles are soon empty, and the heart, now devoid of blood, ceases to beat.

Although this condition of hæmopericardium may usually be recognized and may even be verified by exploratory puncture (Rehn), pleural complications, such as we have described

in our own case, render the diagnosis of heart injury uncertain. Flatness at the base of the left chest with symptoms of hemorrhage indicate at least hæmothorax. This accumulation of blood may come from the lung or from the pericardium, or from both. In many cases this hæmothorax is also a hæmopneumothorax. If the injured vessels alone provide the hemorrhage, the neighboring air-passages are at the same time opened. A wound in the pleural lateral aspect of the pericardium may result in profuse hemorrhage from the heart into the pleural cavity, but such a wound is impossible without concurrent laceration of that portion of the upper lobe of the lung which approximates the pericardial region. Thus, though the hemorrhage may not be essentially from the lung, a degree of pneumothorax is also produced.

This extensive accumulation of blood in the pleural cavity obscures the left border of the heart dulness and may also displace the heart to the right, so that percussion and radiography may give the same appearance to the right of the sternum as in the presence of hæmopericardium. Dyspnœa, shock, air-hunger, and signs of hemorrhage may all be present from lung injury alone. If the heart is transpleurally injured, hæmopericardium does not exist because of the leakage of blood into the pleural cavity. In such instances, therefore, we are deprived of the characteristic symptoms of pericardial tension, which are the most contributory in the differential diagnosis of heart wound alone.

Indications for Operation.—It is evident from the complexity of symptoms which invariably exists in this group of cases, that a definite diagnosis as to the lesions present is usually impossible. Statistics collected by Luxembourg show that the pleura escaped injury in but five of a series of 65 cases. The chances for recovery from both lung and heart injuries must be weighed, then, in most of the cases.

In the well-known publication of Fischer in 1868, with a study of 452 cases of heart injury, we are told that 15 per cent. resulted in spontaneous cure. The exact extent of the heart injury in these cases is not known, and it is conceivable that

complete wounds in the auricles or ventricles were not present.

We are forcibly reminded of the dangers of expectant treatment when we recall, that while 15 per cent. of cases with presumably slight injury may recover spontaneously, 45 per cent. of the operated cases in 13 years have been cured. In other words, statistics alone indicate that operative interference offers the best hope of recovery.

Expectant treatment may be justified in two groups of cases of stab and bullet wounds of the thorax. First: In rare cases direct heart injury alone may be suspected from the localization and symptoms. Intrapericardial tension from hæmopericardium may develop until a small wound in the heart muscle is occluded by the clot formation in the pericardium before the fatal results of heart tamponade ensue. Careful observation of the patient should disclose whether the hemorrhage is restricted and whether or not the pericardial tension is approaching the dangerous limits disclosed by the symptoms above referred to. Second: A group of cases in which the remoteness of the point of injury, the absence of extreme shock and hemorrhage, the lack of symptoms pointing to intrapericardial tension justify the presumption that the heart is probably not injured and that the lung wound is a small one. From such injuries of the periphery of the lung, with slight hemorrhage and an insignificant amount of pneumothorax, recovery is not uncommon. Such cases should be treated expectantly.

If, on the contrary, the hemorrhage is increasing, or the dangers of tension pneumothorax are imminent, even though the point of entrance excludes the possibility of heart injury, operation is indicated for repair of pulmonary injury, and is, with the use of differential pressure, more justified than six years ago. If the pleura and lung are injured and the heart cannot be excluded, immediate operation should be performed in every case. If the point of injury and other symptoms indicate probable heart injury, with signs either of hemorrhage into the pleural cavity or of increasing intrapericardial hemorrhage, operation should not be delayed.

Two new agents are now at our disposal in the operative

treatment of these grave cases, which should increase our enthusiasm to interfere. We refer to transfusion and the use of differential pressure. With the exception of those few cases in which almost immediate death follows injury to the heart, due perhaps to reflex inhibitory stimulation to the heart or respiratory centres, hemorrhage before and during operation is ordinarily a fatal factor when death occurs within 24 hours. Saline infusions have been administered before and during some of the operations reported, with undoubted stimulative effect. Transfusion introduced at the moment of the completion of the heart suture should be of specific value to restore the blood-pressure and to provide the heart muscle with working material.

Statistics show that 75 per cent. of heart injuries are associated with wounds in the pleura. This insures collapse of the lung at operation, whether by the mediastinal or transpleural route. A sudden pathological condition is at this moment introduced. The lung of the uninjured side must perform the oxygenation normally maintained by both lungs. The amount of blood which reaches this lung is diminished by hemorrhage. Complete inspiration is restricted by the oscillations of the mediastinum to the unopened side, and the complete expiration of CO_2 is prevented by the mediastinal movement in the opposite direction (Garrè and Quincke). The one functionating lung is therefore restricted in its efforts at vicarious compensation. Surgeons have been loath to credit a fatality from operation for heart wound to the effects of pneumothorax, for in the presence of profound hemorrhage and manual and instrumental trauma to the heart muscle the presence of air in the pleural cavity would seem to be of secondary importance and an inadequate excuse for death. It cannot be denied, however, that collapse of the lung alone will cause changes in the pulmonary circulation, and does in certain cases markedly and even fatally restrict the respiratory function of the remaining lung. Whether this factor may, in a given case, be of great or partial significance, the prevention of this dangerous element is certainly of value, and the now established

methods of plus and minus pressure to prevent lung collapse will undoubtedly reduce the mortality in these operations. The added advantages in the use of differential pressure to diminish infection by the re-expansion of the lung at the end of operation, and its employment to facilitate the transpleural approach to the heart, we will again consider under operative treatment.

Technic of Operation.—It is to be regretted that a review of the 177 operations for heart injury which have been recorded discloses no particular technic which one can conclude to be the most desirable. No one method of approach has been conspicuously attended with greater success than another. Few fatalities can be accounted for by the method employed, and the unnecessary expenditure of time apparent in certain cases may have been due to lack of skill rather than to method.

In a large proportion of the reported cases, the extrapleural route was selected regardless of the evident involvement of pleura and lung. For this approach to the heart *via* the anterior mediastinum at least twenty different skin incisions and osteoplastic operations have been recommended. The sternum has been bisected and partially resected. Two, three, and four ribs have been divided and reflected outwards or medianwards, or resected for varying lengths with and without the cartilaginous portions. Flaps of skin, muscle, bone, and pleura have been reflected, with division of the ribs at one edge of the flap and fracture at the hinge. The hinge of such flaps has been made toward the median line and away from it. Incisions have been recommended which start vertically over the sternum and extend laterally in a direction parallel to the underlying ribs. The cartilage of several ribs may be divided and intercostal incisions made above and below the upper and lower divided ribs respectively. The rib-and-intercostal-muscle flap may then be sprung away, exposing a window. Operative rupture of the pleura is admitted in many instances wherein the extrapleural route was attempted.

In determining the preferable method of approach in this

group of cases, we must again bear in mind that heart injury
alone is rarely to be considered, and that the pleura and lung
are also involved (Tscherniachowski).   If confronted with the
symptoms of heart tamponade, namely, hæmopericardium, with
increasing tension, with absence of signs pointing to intra-
pleural injury, some method of extrapleural approach through
the precordial space is indicated.   The skin incision and bone
or cartilaginous resection or reflection are determined by the
position of the entrance wound and by the direction of the
entrance canal.   In other words, given a diagnosis of heart
injury alone, a *skin* flap may be reflected which will include
that part of the heart area designated by the external wounds.
The wound canal should then be further explored.   If injury
to the base of the heart is suspected, resection of portions of
the sternum may then be required, together with two, three, or
more costal cartilages.

The employment of a skin, muscle, and bone flap is contra-
indicated for four reasons: (1) Because the size of this flap
must be previously determined and a definite area exposed,
which may or may not be the most suitable one for the injury
at hand.   Reflecting the layers of the chest wall one by one,
on the other hand, enables one to follow the course of the
bullet by degrees, disclosing perhaps that the point of injury
in the heart by no means corresponds to the skin wound.   (2)
The reflection of such flaps favors accidental injury to the
pleura as well as to the intercostal and mammary vessels, which
cannot be easily picked up until the whole flap is reflected.   An
unnecessary loss of blood may thus result (Rehn).   (3) In-
fection has been found to be favored by this flap method, pre-
sumably causing necrosis of tissue along the edges of the
flap, both in the bone and muscle layers.   (4) Air-tight suture
of an osteoplastic flap is difficult.

Intercostal Incisions.—Wilms, Salomoni, Iselin, Floercken,
and Rehn have clearly demonstrated the advisability of an
intercostal incision in the anterior part of the fourth or fifth
intercostal space, which with separation of the adjoining ribs
gives free access to both auricles and ventricles.   They advo-

cate the division of one or more ribs above or below the incision as the case may require, and even the removal of a portion of the sternum if the base of the heart is to be reached. The heart, they claim, may thus be exposed and sutured without injury to the pleura. A further advantage of this intercostal incision rests in the fact, that if the pleura is apparently injured, or if pleura and lung injury is discovered in the course of the operation, a lengthening of this incision outwards will, with the use of a rib-spreader, expose both the lung and heart areas.

This lateral intercostal incision for intrathoracic surgery recommended by Mikulicz, and further advocated by Sauerbruch and Tiegel, has within the past six years become recognized by investigators in intrathoracic problems as preferable to the osteoplastic resection in cases where the thorax is to be closed at the end of operation. With the use of a Mikulicz rib-spreader, or even with retraction with the usual retractors, an operative field will be exposed which few operators can appreciate who have not seen it employed. It has the additional advantage of permitting air-tight closure of the intercostal incision at the end of operation by means of a pericostal stitch which approximates the adjacent intercostal muscles. One of us has employed this technic in a series of 40 pulmonary operations on animals, and is convinced of its practicability.

There is reason to believe that the ultimate technic for this group of injuries, involving either the heart or lung or both, will be the employment under differential pressure of a long intercostal incision, with spreading of the ribs and exposure of both the areas in question. The advantages may be stated as follows:

1. Economy of time. With the employment of differential pressure the pleura may be opened wide without hesitation. There is no loss of time and effort to avoid injury to the pleura, which is usually unsuccessfully attempted in the extrapleural methods.

2. All anxiety concerning the possible fatal effects of pneumothorax is obviated.

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3. Inflation of the lung discloses the injured areas in the lung by the escape of air, facilitating their localization and repair.

4. Differential pressure by maintaining the expansion of the lungs prevents the sagging of the heart posteriorly upwards and to the left.

5. Both auricles and ventricles are accessible, and the posterior cardiac wall as well as the anterior.

6. The reinflation of the lung at the end of operation, followed by tight closure of the intercostal wound, prevents the persistence of pneumothorax which is generally admitted to favor infection, the usual cause of death in these cases which survive the operation itself.

7. The widely exposed field enables the operator to reach and compress the vessels at the base of the heart and control hemorrhage.

When the heart area has been exposed by one of the above-mentioned methods, although the pleural cavity may contain blood, and bleeding wounds of the lung be discovered, the pericardium should be carefully examined and the possibility of heart wound not abandoned, even in the absence of lacerations of the pericardium.   Fourteen cases are now recorded of rupture of the heart muscle in the presence of an intact pericardium.   Wilms explains this at first incomprehensible condition by principles of hydrodynamics.   It presumably occurs only in cases of bullet injuries.   The elasticity of the pericardium may allow the bullet to administer a sudden blow upon the more resistant contracted heart muscle, which produces a rupture rather than a perforation of the ventricular wall. Luxembourg reports a case in which two bullets were found lying in the anterior mediastinum without perforation of the pericardium.   Both bullets were removed and the operation abandoned.   Death ensued, and autopsy revealed a double heart wound which resulted in hæmopericardium and death. It would seem, therefore, that in all cases of this group of chest injuries the pericardium should be incised if there is

any accumulation of blood within it, lest one of these obscured heart ruptures be overlooked.

It is at the moment of the pericardiotomy that the critical point of these operations sometimes arises. All resistance to heart leakage which the pericardium may have hitherto provided is suddenly removed. Our own case provided ample illustration of this situation. Sometimes the hole in the ventricle may be small and the hemorrhage slight. In some cases the blood loss is immediately terrific. If violent hemorrhage exists, an attempt to check it is of primary importance before attempting the suture. Loss of blood previous to this moment may also have been of great consequence. Our own experience is a reminder of the futility of attempting to introduce a needle without regard to the escape of blood. If the wound is in plain view, the stream spurting from a ventricle strikes the eyes of the operator with surprising accuracy. One stitch when introduced and tied is seldom enough to check the flow. Tension on the first stitch with the hope of checking hemorrhage is likely to result in tearing of the heart muscle. This occurred on two occasions in this case. Tension which may be endured by the muscle at diastole is suddenly increased at systole with resulting tear. The trauma to the heart muscle causes immediate increased rapidity of contraction, and the introduction of sutures under these conditions of violent motion and hemorrhage is quite impossible.

Experimental investigation has been helpful in regard to possible means of checking this profuse hemorrhage. Elsberg reports that the rabbit heart will endure a ligature around its central portion which will prevent hemorrhage from openings near the apex. He has successfully sutured such openings, and the ligatures have been tolerated for some minutes. Few wounds in the human heart are suitable perhaps for this method, and the contribution from the experiments is more in showing the toleration of the heart to such extreme trauma.

Rehn, Haecker, Tigerstedt, Noetzel, Lawen and Siever, and Elsberg have determined the length of time which animals will endure the compression of the great vessels at the base

of the heart.   Lawen and Siever conclude that in closure of
the vena cava the lung and coronary circulations remain in-
tact for nine minutes in the rabbit, although distinct disturb-
ances from cerebral anæmia are noted in the interim.   For
three minutes the veins may be compressed without disturb-
ances of either heart or brain.   They state further that com-
plications can be lessened if the compression is omitted from
time to time, even at the expense of a slight loss of blood.
Sauerbruch concludes from experiments that the superior and
inferior cavæ may be compressed for 10 minutes, in which
time the heart-beat is small and irregular.   On removing the
compression, the right ventricle becomes suddenly dilated, and
the heart-beat momentarily ceases.   A more extensive series
of experiments by Haecker results in similar conclusions.

We have substantial experimental evidence, then, that
manual compression of the veins at least is a safe procedure,
if not employed too long or too continuously, and we may say
that in our own operation, being already familiar with these
experiments, the veins at the base were held for intervals
of 15 to 20 seconds, distinctly checking the blood leakage and
facilitating the suture.   The aorta was undoubtedly partially
compressed at the same time, and the effect on the heart-beat
was identical with that described by Haecker and Sauerbruch.
After each temporary compression of the vessels, the heart
seemed less able to recover its original rate of contraction; in
fact, complete cessation and death occurred after the com-
pletion of the suture to the pericardium, within three minutes
of the last compression.   We are by no means prepared to state
that the compression was the cause of the death in this case.
The hemorrhage before operation had been profuse, and even
greater during the operation, this factor alone being an ade-
quate cause of death.   We regret that the compression was not
employed immediately after the pericardium was opened, in-
stead of after attempt at suture without effort to check
hemorrhage had failed.

Looking further for means of hæmostasis during heart
suture, in these cases in which hemorrhage is profuse, we find

possibilities in the use of differential pressure. Sauerbruch, in experimental suture of artificial heart wounds with the use of negative pressure, has noted that allowing the lung to collapse within safe limits has resulted in a slowing of the heart-beat and a concurrent diminution in the hemorrhage from the heart wound. He explains this phenomenon on the basis that the collapsed lung retains more blood than is normal to it, and that resultingly less blood for the time being enters the heart. The slowing of the heart-beat, together with slight dyspnœa, is a well-known symptom of the effects of pneumothorax and lung collapse, and many observers have been impressed with the control of the pulse-rate by raising or lowering the differential pressure.

This application of the "Sauerbruch idea" to heart surgery would seem to argue that the heart-rate and the amount of hemorrhage would be most satisfactory without the use of any differential pressure. As we have stated above, however, we believe that deaths during the heart suture, which have been ascribed to the hemorrhage and operation, have often resulted more especially from the effects of pneumothorax. For the prevention of this, differential pressure is necessary. Its temporary omission or reduction to the amount of 3 mm. of mercury is sufficient to provide the benefits to which we have referred, without permitting the possible fatal effects of pneumothorax.

As regards the technic of the suture itself, little preference can be concluded from our own experience, or from that of others. Death has seldom occurred from subsequent leakage if the suture is once established; in fact one might even conclude that the kind of material is of comparatively little significance. Round needles and interrupted sutures, not including the endocardium, are probably to be preferred.

Drainage.—Of 112 cases of stab and bullet wounds of the heart which survived the operation itself, 67 (60 per cent.) had infections of the pericardium or pleura or both. Forty-one of these died and 26 recovered (Peck). A study of the individual infected cases shows that infection occurred a trifle

more frequently with drainage than without. Rehn and Vaughan accept these statistics as evidence that drainage is not advisable except in cases where hæmostasis has not been complete.

We believe that drainage of the pleural cavity should not be established at the end of operation for two reasons:

First: If a virulent infection has been introduced at the time of injury or operation, the introduction of a drain to the pleural cavity will be insufficient to check the progress of an acute septicæmia. If, on the other hand, the infection is less virulent and confined to the pleura, there is probably no danger in waiting until the symptoms of empyema develop. Adhesions, too, may have occurred in the interim which will tend to localize the septic process. Drainage may then be established with a suction method, which will dispose of the infectious material without permitting complete lung collapse.

Second: It is a well-recognized fact that the presence of pneumothorax favors infection after operation. The presence of drainage at once establishes this unfavorable condition.

In this connection it should be remembered that a closed pneumothorax also favors infection; that is to say, the airtight closure of the thoracotomy wound without previous reinflation of the lung. It is quite as important, therefore, to obliterate the pleural space before closure as it is to omit drainage. If this feature is neglected and the lung is left in the collapsed state, atmospheric pressure persists in one pleural cavity while the normal negative pressure remains in the unopened side of the thorax. The resulting inequality in the pressure of the two sides of the chest prevents the re-expansion of the collapsed lung, and often causes a pleuritic transudate which serves as an admirable culture medium. To prevent this, normal negative pressure in the operated side should be restored, either by artificial inflation just before the tying of the last wall suture, or by aspiration after the closure of the wound. If differential pressure is at hand, the former means is employed without difficulty.

The resistance of the patient, not only to infection but to

the blood loss and shock, is undoubtedly increased by the restored function of the collapsed lung. The balance between the pulmonary and aortic circulation is restored to normal, and the oxygenating surface is not reduced at this time of need.

Concerning drainage of the pericardium, the consensus of opinion is in favor of closure with subsequent aspiration if pericarditis ensues.

Statistics.—The most recent accumulation of stab and bullet wounds of the heart is that of Grisogono, who adds to the statistics of Salomoni and Peck eight additional cases, making a total of 172 with 69 recoveries. In addition to these the following cases have been collected from the literature of 1910:

1. GUINARD (*Bull. et mém. Société de Chir.*, Paris, 1910, n.s., xxxvi, 162) : one case of bullet wound, death.

2. FOEDERL (*Wiener klin. Wochenschrift*, 1910, xxiii, No. 25) : one case of bullet wound, recovery.

3 and 4. RASSIEUR (*Journal Missouri Med. Assoc.*, St. Louis, 1909-10, vi, pp. 316-320) : one case of bullet wound, recovery; one case of stab wound, death.

5. BREWSTER and ROBINSON : one case of bullet wound, death.

It was a surprise to find that of a total of some 177 heart injuries only 24 were produced by bullets. The feature which is noticeable in the following table of bullet wounds is the comparative frequency of wounds of both walls of the ventricles, while in stab wounds a single wound is the rule. The percentage of mortality is not unlike that of heart wounds in general. From the number of stab wounds which have been reported one might conclude that bullet wounds are more often immediately fatal. A large proportion of the stab wounds are reported from parts of Europe where knife wounds are of more common occurrence.

CONCLUSIONS.

1. The diagnosis of heart injury is usually difficult.

2. Heart wounds rarely exist without pleural or lung involvement.

3. Operative rather than expectant treatment is indicated in a large proportion of the cases.

TABLE OF SUTURED BULLET WOUNDS OF THE HEART TO DECEMBER, 1910.

No.	Operator and year.	Time elapsed before operation.	Location of bullet wound.	Method of exposing heart.	Cavity wounded and treatment.	Drainage of—		Complications.	Result.
						Pericardium.	Pleura.		
1	Bardenheuer, 1904	……	……	……	Heart perforated; entrance and exit wounds sutured	……	……	Pericarditis and pleuritis	Death 2 days later.
2	Bardenheuer, 1904	……	……	Sutured……	L. v.; sutured……	……	……	Pericarditis; septic pleuritis	Death 10 days later.
3	Bougie, 1901	½ hour.	Bullet in 3d left space; a finger's breadth from sternum	Flap of 3d, 4th, and 5th cartilages; hinge external	Right ventricle; 2 holes, both sutured with catgut	No……	Yes……	Bullet passed through wall of ventricle not opening cavity	Death 5 hours later.
4	Brezard and Morel, 1905	Soon……	Bullet (8 mm.) in 3d left space, 2 cm. from sternum	Flap of 3d, 4th, and 5th ribs; hinge external	Left ventricle; 2 wounds, entrance and exit, sutured with catgut	No……	……	Cavity of ventricle not opened	Died on table; hemorrhage.
5	Bufnoir, 1899	……	Gunshot wound in 5th left space; 22 calib.	……	Right ventricle; 1 opening sutured	……	……	Ventricle perforated sutured	Died.
6	Fittig, 1908	2 hours.	Pistol-shot wound in 3d left space, internal to nipple	Intercostal incision in 4th space; resection of 4th and 5th ribs	Left ventricle; 2 wounds, anterior and posterior, 3 cm. and 1 cm., 6 catgut sutures in anterior wound	Yes……	Yes……	Ventricle perforated; exit wound not sutured	Died 24 hours later; anemia.
7	Goebell, 1905	1 hour.	Pistol ball, 7 mm..	Flap of ribs; hinge external	Left ventricle; entrance and exit; both sutured with catgut	Yes……	Yes……	None…………	Recovered.
8	Launay, 1902	4 hours.	Pistol ball, 7 mm. in left nipple	Flap of 4th, 5th and 6th ribs; hinge external	Left ventricle; perforated, entrance and exit closed with catgut sutures	Yes……	Yes……	……	Recovered.
9	Lenormant, 1905	7 hours.	Pistol ball in 5th left space at sternal border	Flap of 4th, 5th and 6th ribs; hinge external	Right ventricle; 15 mm. 3 silk sutures; liver, stomach, and bowels wounded	Yes……	……	Syncope on table; traction on tongue and heart massage revived him	Died 4½ hours later.

								Pericarditis; aspirated	Recovered.
10	Manteuffel, 1903	9 hours.	Pistol ball, 5 mm. in 4th left space	Resection of 4th, 5th 6th, and 7th cartilages	Right ventricle; went through anterior wall and lodged in posterior, where it could be felt. Incision and removal. Silk sutures closed both wounds	No....	Yes...		Recovered.
11	Marion, 1898.	2 hours.	Pistol ball, 4th left space, 3 cm. from sternum	Resection of 6th and 7th cartilages and part of sternum	Right ventricle, perforated, anterior wound sutured	....		Ball did not open pericardium	Died on table.
12	Morestin, 1903	2½ hours	Pistol ball, 8 mm. in sternum opposite 4th cartilage	Cut through sternum	Right ventricle; 1 opening; 4 catgut sutures	Yes...		Ball found in cavity of right ventricle	Died 19 hours later, from embolism(?)
13	Noll, 1903....	1½ hours	Pistol ball, 7 mm. in 1st left space	....	Left ventricle; wound sutured	Yes...		Pleurisy.........	Recovered.
14	Riche, 1904..	1½ hours	Pistol ball, 8 mm. in 5th left space, within and below nipple	Flap of 3d, 4th, and 5th ribs; hinge external	Left ventricle; 2 wounds; catgut sutures in both	Yes...			Died on table.
15	Rimann, 1909	1½ hours	Gunshot wound perforating 3d rib	Resection of 4th and 5th cartilages	Left ventricle; 5 silk sutures	No....	No....	Serous pleuritis; aspiration 12 days after operation	Recovered.
16	Rothfuchs, 1905	....	Bullet...........	Resection of 4th and 5th ribs	Left ventricle; perforated; catgut suture in both wounds		Yes...	Ball went through stomach and lodged in diaphragm	Died 24 hours later; peritonitis.
17	Schubert, 1904	¾ hour..	Bullet in 4th left space	Resection of 4th rib	2 wounds in heart, 1 anterior, 1 posterior, both sutured with catgut			Operator thought bullet passed through interventricular septum without opening a ventricle	Recovered.
18	Sultan, G., 1907	30 hours	Pistol ball, 9 mm. in 5th left space inside nipple line	Flap of sternum and left 4th and 5th cartilages; hinge on right	Left ventricle; cavity not opened; 3 silk sutures		(?)	None............	Recovered.
19	Vidal, 1908..	1½ hours	Bullet wound in 4th space, 10 cm. from median line	Incision in 3d left space without resecting ribs, under positive pressure. Pleura freely opened	Left ventricle; 2 sutures	No....	No....		Recovered.
20	Wilms, 1906..	2 hours	Pistol ball, 6 mm....	Intercostal incision	Left ventricle perforated; both sutured	No....	No....	None......	Recovered.

1 Not opened.

TABLE OF SUTURED BULLET WOUNDS OF THE HEART TO DECEMBER, 1910.—Continued.

No.	Operator and year.	Time elapsed before operation.	Location of bullet wound.	Method of exposing heart.	Cavity wounded and treatment.	Drainage of—		Complications.	Result.
						Pericardium.	Pleura.		
21	Rassieur, 1909	....	Gunshot wound 4th left space just below and internal to left nipple	Resection of 4th and 5th ribs	Left ventricle; 3 silk sutures; pericardium closed	No....	No....	Empyema........	Recovered.
22	Foederl, 1909	....	Gunshot wound in 5th left space 2 fingers below and internal to mammary line	Flap of 4th, 5th, and 6th ribs; hinge inwards	Left ventricle; injury in pericardium and pleura, both closed	....	....	Pneumothorax overcome with positive pressure with oxygen mask apparatus	Recovered.
23	Guinard, 1909	20 minutes	Revolver shot 3d interspace 1 cm. internal to mammary line	....	Left ventricle; 2 holes in pericardium in left wall, both had crossed base of heart; 3 catgut sutures to each	No....	No....	Emphysema......	Death 3 hours later.
24	Brewster and Robinson, 1909	6 hours	Bullet wound penetrating 5th left rib near nipple line	Quadrilateral incision; division of cartilages, 3d, 4th and 5th ribs, with double intercostal incision	Left ventricle; sutured with catgut	No....			Death at closure of pericardium.

4. Osteoplastic flaps should not be employed.

5. Intercostal incision, with or without subsequent division of ribs, is the preferable method of approach.

6. In certain cases the heart wound may be of sufficient size to permit violent hemorrhage at the time of suture. In such cases interrupted manual compression of the superior and inferior cavæ may be a possible safe procedure; the profuse hemorrhage without this compression is of greater danger.

7. Differential pressure with apparatus is by no means a *sine qua non* in all operations for wounds of the heart and lungs. It is, however, a valuable agent to control the respiratory function, to regulate the heart-beat, and to reinflate the lung at the end of operation.

8. Air-tight closure of the pleural cavity with reinflation of the lung should be employed when possible; the intercostal incision followed by a pericostal stitch is a successful method of securing tight closure.

9. Drainage of the pericardium is unnecessary.

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THE IMPORTANCE OF PRESERVING THE GALL-BLADDER IN OPERATIONS UPON THE GALL-PASSAGES.*

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THE object of this paper is to emphasize the importance of retaining the gall-bladder whenever it is possible to do so.

In the upper part of the abdomen the gall-bladder is the surgical landmark. From this innocent-looking side-pocket we must take our bearings always. In making the diagnosis, it matters not whether the lesion be ultimately found in the duodenum, stomach, liver, pancreas, or elsewhere in the neighborhood, our perspective of the situation is neither clear nor comprehensive if we fail to include the gall-bladder in the field of vision, and in differentiating, convict or exclude it from complicity in the morbid process.

Just in the proportion that we give the gall-bladder the first consideration will its importance manifest itself. The more one operates the more he realizes the pre-eminence of this organ in its relation to its correlated group.

When we remember that more than ten times as many operations are done on the gall-bladder as on all the other organs in this region combined, the foregoing assertion can scarcely be questioned.

Following the first cholecystectomy by Langenbuch in 1882, and observing the oftimes brilliant results obtained, surgeons were quick to adopt the method of extirpation in preference to drainage. Not only cases with positive indications were subjected to cholecystectomy, but those on the border-line and in many instances cases that we know to-day would have done quite as well or better with a cholecystostomy. In the pres-

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* Read before the Southern Surgical and Gynæcological Association, December 13, 1910.

ence of the stones and their infected container, surgeons seemed
to lose sight of the function and therapeutic value of the gall-
bladder.   I confess that formerly I taught that cholecystec-
tomy was ideal, therefore the operation of choice, getting rid
at once of an infected, obstructed organ, as well as the irritat-
ing stones.   A critical analysis of 86 operated cases, 20 of
them done this year, has led me to think differently, so that
my present custom is to never remove the gall-bladder unless
the conditions present appear to make it imperative.

The circumstances under which a cholecystostomy would
better conserve the interests of the patient may be best under-
stood by first discussing briefly the indications for cholecystec-
tomy.

In the presence of a new growth, particularly primary
carcinoma not yet advanced too far, no one would think of any-
thing else than extirpation.   In the abundance of precaution
it is also a wise practice when doing cholecystostomy to snip
out a piece of the gall-bladder for the microscope for fear an
unsuspected carcinoma may be present.

If the whole thickness of the bladder walls be gangrenous,
there is no other course to pursue than to remove it.   How-
ever, on several occasions I have been able to preserve the gall-
bladder where the mucosa was frankly gangrenous with the
muscularis and serosa in the earlier stages of the same process,
by doing cholecystostomy; the mucosa sloughing away and res-
toration taking place in the other layers.

An enormously dilated gall-bladder, when infected and
ulcerated, especially if dislocated, should be extirpated.   I have
one such bladder half as large as the stomach in my collection.
Perhaps the degree of infection, the ulcers, and position rather
than the size determined me in this instance.

Empyema of the gall-bladder is a relative indication for
cholecystectomy.   Here again the intensity of the infection, not
forgetting the involvement of other organs, must help to decide
the question.

The presence of the empyema presupposes closure of the
cystic duct.   Formerly I felt that if there were no bile in the

gall-bladder the obstruction of the cystic duct was complete and hopeless, but I have come to realize that removal of the stones and septic fluid with drainage will, as a rule, restore the patency of the duct. On adopting cholecystostomy in preference to cholecystectomy in this class of cases, I was at first disturbed because the bile did not begin to flow at once or within a few hours. As experience accumulated, however, I noticed that the discharge of bile was established only after a varying interval, often from three to seven days, in one case on the fifteenth day. It would seem that the closure of the duct is due not only to the presence of the stones but to swelling of the duct mucosa, just as the hypertrophied mucosa of the turbinates closes the nostrils. It should be set down as a rule that in most instances the atresia of the cystic duct is apparent rather than real. Surgeons have been slow to recognize this fact, which once admitted removes empyema from the list of positive indications for cholecystectomy.

It must be rare indeed that a stone impacted in the cystic duct justifies extirpation of the bladder. I have never failed to dislodge the stone except it be in a case like the following, in which years before the gall-bladder had emptied itself into the stomach and the cystic duct and bladder were reduced to an impervious cord, literally crushing the imprisoned stones into the tissues. Drainage had to be made direct from the common duct, which, with the hepatic duct and its various branches, was filled with soft putty-like stones. Lesser grades of tissue destruction from stone impaction do not call for extirpation of the bladder.

Wounds of the gall-bladder are usually considered an indication for ablation. However, unless the trauma is very destructive it is better to drain, for two reasons: first, because drainage preserves the gall-bladder; and second, the fear of normal bile which may escape into the abdomen, producing peritonitis, is unfounded.

Even perforation from ulceration should not be considered an absolute indication for cholecystectomy. Only recently I drained a bladder that was perforated and most of the fifty

stones had escaped into the liver.   The patient had been having rigors and high fever.   Prompt recovery followed.

In another instance three square stones one-half inch on each facet had ulcerated their way through the side of the gall-bladder and into the common duct.   Drainage of the common duct and the gall-bladder brought about perfect recovery.   Five years later I opened the abdomen of this same patient to remove the appendix and was astonished to see how nearly normal the gall-bladder and ducts were.   In fact there was no occasion for questioning their function.

There are perhaps other indications for cholecystectomy but these are the most common.

The Value of Drainage—the Essence of Cholecystostomy. —Drainage is second in importance only to removal of the stones, in fact more so under some circumstances.   For instance, removing stones cannot cure a pancreatitis, drainage does.   There is no organ in the body, not excepting the Fallopian tubes, that being once badly damaged responds more effectually to drainage than does the gall-bladder.   Attention has already been called to the fact that acute infection, empyema, gangrene, obstructed cystic duct, and even perforation may be overcome by drainage.   Moynihan [1] says: " One point cannot be too frequently or too strenuously emphasized, that is, that drainage is the secret of success in gall-bladder surgery."

But over and above the value of drainage to the bladder itself, drainage is the *sine qua non* for curing the patient of the wide-spread sequelæ of the gall-bladder infection.   This is best done through and around the gall-bladder.   True, the liver and pancreas may be drained through a tube in the common duct, but never so safely, and certainly only for the time being.   So important is drainage that when it becomes necessary to do cholecystectomy it is a safe precaution to leave the forceps instead of a ligature on the cystic duct, in order to be able to open the duct and allow a free flow of bile should untoward symptoms develop.

If there were no other reason for retaining the gall-bladder

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[1] Gallstones and Their Surgical Treatment, Moynihan, p. 354.

whenever possible, its intimate anatomical and physiological relations to the pancreas would be sufficient justification. Embryologically it was probably a wise provision to develop so necessary an organ as the pancreas, like the uterus, from two separate points—one bud arising from the posterior wall of the primal tube and the other from the anterior wall in connection with the gall-bladder outgrowth. At first the posterior bud is the more vigorous, developing a large duct (Santorini), but soon the anterior bud forges ahead and fuses with its twin, becoming the main portion with its larger duct (Wirsung). As the gall-bladder and pancreas develop and recede from each other, only their ducts remain united, but in such manner that the function of each organ is in a sense blended with that of the other. Surely such relations mean something.

The gall-bladder has long since ceased to be regarded merely as a storage pouch for bile. The disparity between its capacity and the amount of bile secreted daily is proof of this. Rather should it be considered the *expansion tank* for the bile-duct system. It has been frequently observed in cases where the gall-bladder had long since been destroyed, also following removal of the gall-bladder, that there was a marked dilatation of the common and hepatic ducts, even the little nub remaining of the cystic duct dilating, the dilatation compensating, as it were, for the loss of their expansion tank.

Experimental physiology has demonstrated curiously enough that pure bile injected into the pancreatic duct will cause fatal pancreatitis (Opie, Washington University *et al.*); while mucus from the gall-bladder mixed with the bile greatly modifies its toxicity (Flexner), a cogent reason, it seems to me, for preserving this function of the gall-bladder.

It is interesting to note in this connection how often pancreatitis occurs when the function of the gall-bladder is held in abeyance by disease. We are all familiar with this picture. Under date of December 2, 1910, W. J. Mayo writes: "We have made 3870 operations on the biliary tract, and 7 per cent. of the total had pancreatitis, and 24 per cent. out of 469 operations on the common duct had pancreatitis." This large per-

centage of pancreatitis complicating diseases of the bile-duct system is perhaps the strongest reason that could be advanced for preserving the gall-bladder. What other means have we of dealing with a chronic inflammation of the pancreas? and how truly wonderful are the results! I would like to ask how many surgeons present, after feeling of an enlarged, nodular pancreas marked the case "doubtful," and were surprised to see a perfect recovery ensue under the beneficent influence of drainage. Only a little while ago I drained a perfectly normal bladder because the patient had chronic pancreatitis, with the most satisfactory results.

Drainage is not only essential for the pancreatitis already present, but who knows when a healthy pancreas may become diseased, therefore it is pertinent to retain this avenue of approach. Mayo says, "I quite agree with you that the gall-bladder should be saved wherever possible."

I might add that there are other occasional conditions, such as irremovable obstruction at the duodenal end of the common duct, or indeed, any condition which would justify the operation of cholecystenterostomy—all of which are additional reasons for preserving the gall-bladder.

RETROPERITONEAL AND MESENTERIC CYSTS OF A SIMPLE NATURE.

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OF LONDON,

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THE recent presence in my wards of two simple retroperitoneal cysts affords an opportunity for a short review of the nature, the clinical characters, and the resulting symptoms of such cysts.

CASE I.—The first case was one of the so-called retroperitoneal variety. H. W., aged thirty, a professional athlete and a strong muscular man, had enjoyed perfect health until the time at which he came under observation. Six weeks previously he had sustained a kick in the right hypochondriac region, which gave rise to only moderate pain and did not prevent his playing the game of football out, and since that date he had been playing football regularly. The patient himself was the first to notice a swelling beneath the upper part of the right rectus muscle, and when examined later by Dr. Macewen a subhepatic tumor was palpable.

On examination the prominence of the right rectus muscle was obvious, and on palpation a tumor giving the sensation of a smooth, elastic, tense cyst, moving freely with respiration, and giving a dull note on percussion, was readily felt.

The only symptoms complained of were those of gastric flatulence, and these had been steadily increasing during the past three weeks. Examination of the urine revealed the presence of a trace of bile. The size and position of the cyst, and the latency as far as symptoms were concerned suggested a subhepatic hydatid, but apart from the presence of the tumor no enlargement or displacement of the liver could be detected.

An exploration having been decided upon, a supraumbilical incision carried into the abdominal cavity by separation of the fibres of the rectus muscle was made. The cyst at once presented, covered by the peritoneum of the posterior abdominal

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wall and the upper layer of the transverse mesocolon. The descending portion of the duodenum and also a portion of the first part were spread out on the anterior surface of the cyst, which also insinuated itself to some extent between the layers of the gastrohepatic omentum. The gall-bladder lay in direct contact with the right aspect of the cyst. A vertical incision through the peritoneum was made over the most prominent portion of the tumor, its tension was decreased by partial evacuation of the contents by a trocar and canula, and the cyst was stripped out of its bed, mainly by the aid of "gauze dissection." The separation was not very easy in consequence of some inflammatory infiltration of the subperitoneal areolar tissue. The duodenum was first stripped off, and then a connection of some four to five inches in length with the inferior vena cava was separated. The portal vein and bile-ducts lay behind the cyst. When the removal had been completed the gap in the posterior peritoneum was repaired by suture, and the abdomen was closed in the ordinary manner. The patient made a rapid and uneventful recovery from the operation.

The cyst was thick walled and practically unilocular, although the interior exhibited some shallow septa, indicating an originally multilocular character (Fig. 1). Microscopically it was composed of dense connective tissue, and no endothelial lining could be demonstrated. The contained fluid was milky in appearance, suggesting chyle. Microscopical examination, however, demonstrated the absence of any fat globules, and this observation was confirmed by chemical examination, the milky turbidity being due to the presence of a colloid substance precipitable by alcohol. No sugar was present. Some amorphous bodies were seen with the microscope but no cellular elements.

CASE II.—For permission to use the second case I am indebted to my colleague, Mr. Percy W. G. Sargent.

C. J. S., aged forty-eight, a carpenter. Except for a history of the occasional passage of small quantities of bright blood per anum, the patient had enjoyed good health until eighteen days before his admission to the hospital. On that day he slipped and fell on his back. Although no immediate ill-effect was experienced, the fall was followed after four days by a dull pain localized in the region of the umbilicus. This pain gradually increased in severity, and during the last six days of his illness

FIG. 1.

Retromesenteric subhepatic cyst. Note septum indicating original multilocular character (Case I).

FIG. 2.

FIG. 3.

Multilocular mesenteric cyst. Note projection of smaller cysts into the lumen of the bowel (Case III).

Multilocular mesenteric cyst. Note situation of intestine in the hollow between two prominent cysts.

was acute, the maximum point of both pain and tenderness lying just to the left of the umbilicus. The pain bore no relation to the ingestion of food, and was unaccompanied by nausea or sickness. The bowels were constipated until a dose of castor-oil had been taken. The patient himself noticed no enlargement in the abdomen until his attention was called to it after his admission into the hospital.

On inspection of the abdomen a local prominence was apparent in the umbilical region, and on palpation this prominence corresponded with a tumor of definite outline occupying the umbilical and extending into the left lumbar region. There was marked intestinal distention, with uneven prominence to the left and below the level of the umbilicus. The surface of the tumor itself was smooth, it was tender on palpation, dull on percussion, and a distinct fluid thrill could be elicited in it. There was no evidence of free fluid in the peritoneal cavity, but the feet and legs were œdematous. The urine had a specific gravity of 1026, and apart from the presence of an excess of urates was normal.

The patient was suffering greatly from pain, and an immediate exploration was performed by Mr. Sargent. A right paramedian incision exposed a large tumor, which after enlargement of the opening was delivered onto the surface of the abdomen, and its retroperitoneal situation determined. The peritoneum of the posterior abdominal wall was incised over the tumor and the latter dissected out, a proceeding accompanied by a considerable amount of hemorrhage. The difficulty in controlling the considerable parenchymatous bleeding suggested the inadvisability of closing the gap in the posterior wall, and the edges of the posterior peritoneum were brought up to the margins of the anterior abdominal wound and there sutured. The cavity thus excluded from the peritoneal space was plugged with gauze. The operation was followed by an uninterrupted recovery.

The cyst in this instance appeared to be located between the layers of the sigmoid mesocolon and behind the pelvic colon. The wall consisted of fibrous tissue, amongst which was much lymphoid tissue. No epithelial lining was determinable.

These two cases represent the typical unilocular retroperitoneal cyst, though in the first, evidence of an earlier

multilocular condition was furnished by the presence of septa which had undergone atrophic absorption. It each case the exact situation was at the root of the mesocolon.

In the following two cases the cysts were situated in the folds of the mesentery of the small intestine.

CASE III.—F. T. G., aged six. Since infancy this child had been subject to attacks of abdominal pain, the onset of pain being shortly followed by vomiting. The action of the bowels had always been regular. For six weeks before the date of admission to the hospital these attacks of pain and vomiting had been becoming more frequent and severe, the child began to lose flesh, and the abdomen became much distended.

On admission to the hospital the child, although thin, was healthy in appearance and cheerful between the attacks of pain.

On inspection of the abdomen a central prominence was apparent, and on palpation a large tumor was detected extending from the pubes upward to the costal margin, but most prominent in the umbilical region. The abdomen was dull on percussion except in the flanks and a narrow band of resonance above the pubes. The tumor was not tender, and appeared freely movable. The urine was normal.

An exploration being decided upon, the abdomen was opened by a paramedian incision four inches in length, with outward displacement of the rectus muscle. A dark-colored cyst at once presented, which was emptied of a quart of dark-colored chocolate fluid by a trocar and canula. The remaining mass was then delivered by traction on the large emptied cyst; it proved to consist of three additional thin-walled cysts, each about the size of a small orange, containing clear colorless fluid, and situated between the layers of the mesentery (Fig. 2). About three inches of the jejunum was flattened out and closely applied to one of these cysts, and as it appeared probable that stripping out of this cyst would dangerously interfere with the vascular supply of the bowel, the latter was resected and removed together with the cysts. An axial union of the bowel was then made, and the abdomen closed.

The wall of one of the larger cysts beyond the fibrous tissue contained bundles of plain muscle-fibre all passing in one direc-

tion. The contraction of these fibres had raised the internal wall of the cyst into a series of fine ridges. There was no endothelial lining. The child made an uneventful recovery.

CASE IV.—E. B., aged thirteen, was admitted into the hospital with a history of nine days' obstruction, persistent vomiting (stercoraceous on admission), and abdominal distention. By the rectum a smooth elastic mass could be felt anteriorly. Mr. Clutton opened the abdomen and removed a large group of mesenteric cysts, the largest of which involved a knuckle of the small intestine which was resected. The two ends of the divided bowel were brought out of the abdominal wound, a lateral anastomosis between them being established within by means of a Murphy button. Death ensued three days later from acute general peritoneal infection, due to sloughing and perforation at the site of the button (St. Thomas's Hospital Museum 11 49 a.).

Origin and Nature of the Cysts.—These cysts are of lymphatic origin, resembling in nature the so-called hydrocele of the neck, and the multilocular lymphatic cysts of the axilla or the spermatic cord.

The unilocular cysts are usually the larger variety as far as an individual cavity is concerned, but in most cases examination of the interior shows the existence of more or less prominent ridges or septa on the wall, indicating an original multilocular condition. They are most commonly situated in a retroperitoneal position, and by appropriating to themselves the peritoneum of the mesenteries, tend to fix the corresponding portion of bowel and to encroach upon its lumen. Of the two cysts described above, one originated at the root of the transverse mesocolon, the other at the root of the sigmoid mesocolon. Such cysts have been known to change their position—thus in an instance recorded by Narath the swelling travelled downwards like a spinal abscess, and eventually reached the front of the right thigh.

The multilocular tumors are more commonly situated in the mesentery of the small intestine, and are composed of separate globular cysts of varying size.

The cyst wall is composed of fibrous tissue; in the multi-locular variety the wall is often very tenuous, in the unilocular it is much thicker. An endothelial lining is frequently not demonstrable. The contents, when no secondary change has occurred, may consist in a thin, colorless, transparent, lymphatic fluid, or the appearance may be " chylous." It is noteworthy that in the first of the cases described above, although the fluid was chylous in appearance, no free fat globules were demonstrable, neither was any cellular element discovered on microscopical examination.

Secondary Changes.—Of these, simple enlargement is the most common. The rate of increase is slow, but it may be accelerated by injury. The most common accident is hemorrhage into the cyst cavity, under which circumstance enlargement may be rapid (Case II). The hemorrhages may be recurring, in which case the cyst may reach an enormous size and its wall become greatly thickened by the deposition of laminæ of fibrin. I once drained a cyst of this nature from an opening in the left loin; the contents consisted of old altered blood, while the cavity with a wall three-quarters of an inch thick had reached a size corresponding to a third of that of the whole abdomen. The cyst wall itself had become inseparably connected with the surrounding structures.

Signs and Symptoms.—Inspection of the abdomen may at once reveal the presence of a localized enlargement, while on palpation a definite elastic cystic tumor may be detected and a fluid thrill elicited. When the cyst is of the unilocular retro-peritoneal variety, the position is usually a fixed one, while the multilocular cysts of the mesentery of the small intestine are more irregular in outline, and free mobility is the rule. The cysts between the layers of the mesentery of the small intestine are moreover practically central in position, while the unilocular, although generally corresponding to the root of some part of the mesentery of the large intestine, may be situated in almost any part of the abdomen.

In two of the instances recorded above, the cyst was readily palpated by rectal examination, and bearing in mind

the possibility of stretching or dragging down of the root of the mesentery from its attachment to the posterior abdominal wall, the descent of the cysts into the pelvis would naturally be expected to occur sooner or later.

Symptoms.—In the production of symptoms the behavior of these cysts closely resembles that observed in hydatid disease.   For a long period a latent character is preserved, then augmentation in size of the cysts and gradual increase in the degree of pressure exerted on the surrounding viscera may give rise to pain, flatulence, constipation, or actual obstruction of the bowels.   Thus in Case I symptoms of pyloric and duodenal obstruction developed, as also evidence of slight pressure on the common bile-duct, shown by the presence of bile pigment in the urine.   In Case III recurring attacks of abdominal pain and vomiting were probably accounted for by changes in the position of the tumor.

The gradual nature of the enlargement of the cysts, however, allows for considerable adaptation, and serious pressure symptoms in the absence of accidental changes in the cysts themselves must be regarded as late phenomena.   Cases I and II go to prove that the reception of an injury may result in a sudden or rapid increase in the size of the cysts, independent of the occurrence of hemorrhage, such increase corresponding with the development of definite pressure symptoms.   In neither were the symptoms severe, but they amply sufficed to draw attention to the condition.   The occurrence of intracystic hemorrhage is a more important event, for here intestinal obstruction may be acute and complicated by symptoms dependent on the loss of blood.   The actual mechanics concerned in the production of obstruction of the bowel vary considerably, thus the intestine may be stretched as a broad ribbon over the prominent cyst as in Case III, the intestine may be sunk in a deep hollow between two cysts as in Fig. 3, or small individual cysts may project towards the lumen of the bowel as in Fig. 2.   The tumor by its weight may drag on the intestine, or a change in position of the tumor may cause an actual kink.

Diagnosis.—The diagnosis must usually be made by the process of exclusion. A definite opinion is most readily reached in the case of young children with cysts situated in the mesentery of the small intestine; in them no other cyst in a similar high central position is often met with.

In adults a number of cystic tumors need to be taken into consideration.

Hydatid cysts perhaps form the most difficult problem, as in Case I, where the situation was especially favorable to such a diagnosis being made. No examination of the blood was undertaken, but it may be remarked that the absence of eosinophilia might have been determined as a factor in the conclusion to be arrived at.

Pancreatic cysts are usually situated somewhat higher in the abdomen, they are less movable than the central mesenteric cyst, more frequently accompanied by gastric disturbance, glycosuria may be present, also evidence of deficient pancreatic digestion on examination of the stools. Again, in the traumatic pancreatic pseudocyst, a history of really severe symptoms is usually to be obtained.

Sarcomatous cysts: In these the rate of growth is more rapid, and pain, as in the solid retroperitoneal sarcomata, is an earlier and more prominent symptom.

Cold abscess: Where the presence of a localized fluctuating tumor is the main or almost only feature, this possibility needs consideration, and the case of Narath, in which the cyst " pointed " in the thigh, shows that considerable difficulty may arise. The diagnosis will mainly depend on the detection of the primary focus of the disease by the ordinary methods employed in dealing with any obscure case of tuberculosis.

Ovarian cysts: The fact that mesenteric cysts may be readily felt on rectal or vaginal examination and that they are movable in many instances may lead to some difficulty. Case III in point of fact did very closely resemble one of ovarian cystic disease. It may be noted that rectal examination usually allows the absence of pelvic anchorage to be determined, also that elevation of the pelvis may allow the

tumor to escape from contact with the finger and take up a higher position in the abdominal cavity.

Lastly, the history and symptoms usually accompanying an uronephrosis or a distended gall-bladder should usually prevent any confusion with either condition.

Treatment.—The treatment of mesenteric cysts has been sufficiently outlined in the series of cases here reported.

The ideal procedure is enucleation of the cyst and the avoidance of any interference with the continuity of the alimentary canal. In the case of the unilocular retroperitoneal cysts, this course may usually be adopted without difficulty. If changes have led to a so firm fixation of the cyst in its bed that the dissection necessary for its enucleation gives rise to parenchymatous hemorrhage difficult to control, the method successfully adopted by Mr. Sargent in Case II is admirable.

In the case of the multilocular cysts, enucleation may be impracticable without dangerous interference with the integrity of the blood supply, or the condition of the intestine when obstruction of any standing is present may render its preservation undesirable; it may then be necessary to resect the implicated portion of the small intestine, as was done in Case III.

THE ABDOMINAL INCISION—THE REMOVAL OF THE WEDGE OF SKIN AND FAT TO FACILITATE INTRA-ABDOMINAL OPERATIONS.

BY HOWARD A. KELLY, M.D.,

OF BALTIMORE, MD.,

Professor of Gynæcology in the Johns Hopkins University.

In an article on " Excision of the Fat of the Abdominal Wall—Lipectomy," [1] I recommended large excision of skin and fat from the overweighted abdominal wall in obese women. Such an operation serves the purpose of reducing their avoirdupois, and at the same time renders the patient less unwieldy by taking some pounds of fat from a part of the body where it is most awkward to carry it. It is also cosmetic and serves the purpose of cleanliness. This operation, to which I gave the name " lipectomy," bids fair to be extensively used in this country as well as abroad. It has been considered by Weinhold [2] and by A. E. Maylard.[3]

Dr. Maylard, of Glasgow, in a most interesting and thoughtful article on the " Direction of Abdominal Incisions," describes two cases in which abdominal walls were resected, removing ten pounds and eleven ounces, and six pounds and two ounces, respectively, the incision in each case being 21 inches in length.

A number of surgeons also in our own country, without having specially reported their cases, have relieved excessively obese patients by a similar procedure.

The matter I now wish to speak of, though bearing a superficial resemblance to the operation of lipectomy, is rather an adaptation of the same idea to another field and for quite another purpose.

Every surgeon knows well how the difficulties of intra-

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[1] Surgery, Gynæcology, and Obstetrics, March, 1910.

[2] Cent. f. Gyn., No. 38, Sept. 18, 1909, p. 1332.

[3] Brit. Med. Jour., Oct. 5, 1907, p. 895.

FIG. 1
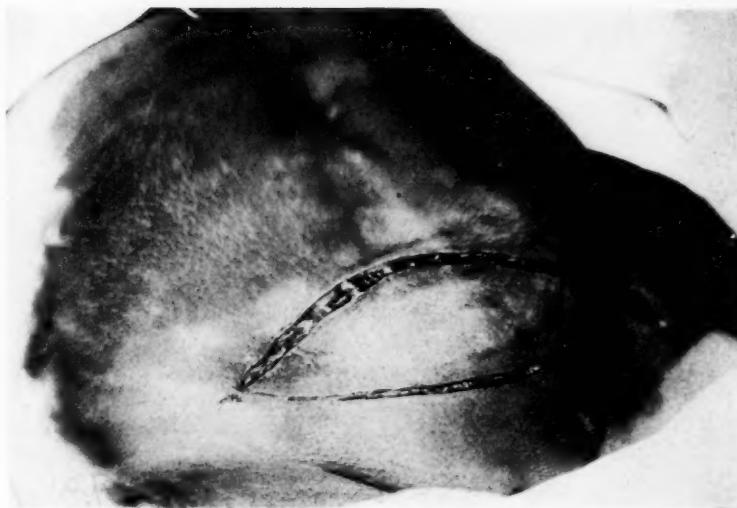
Oval incision for the removal of a sector of skin and fat to get the embarrassing superficial tissues out of the way in operating upon the deeper abdominal structures. The dark color of the abdomen is due to the tincture of iodine.

FIG. 2.

The wedge of skin and fat being lifted away, the upper part of the incision is hauled up, showing the extent of the linea alba, which is accessible for a vertical incision into the abdomen even when the skin and fat are removed transversely.

abdominal operations in a stout patient are often greatly en-
hanced by thick abdominal walls which increase the distance
of the tissues to be treated from the surface, compelling the
operator to work, as it were, through a long funnel. On the
other hand, almost all abdominal operations, however difficult,
if they could be transported onto the surface of the body,
would become comparatively easy. Any one, for example,
could cut into a common duct and sew it up or lay bare a
pelvic ureter without injury if these structures were disposed,
for example, close to the surface of the body. The more
distant the structure is from the superficial plane of the body
the more difficult those delicate operations become, just on
account of the remoteness and for no other reason. In some
cases actual suturing is made impossible by nothing else than
these vexing mechanical difficulties of the situation, the un-
get-ativeness of the parts, so to speak. This awkwardness I
have been able to obviate in most instances by a large oval
excision of the skin and fat down to the abdominal wall,
removing a skin section either in a transverse or in a vertical
direction, corresponding to or at right angles with the incision,
about 8 or 10 inches in length by 3 or 4 inches in width. This
does away with the thickness of the wall down to the fascia,
while from the fascia inwards the difference between differ-
ent abdomens is not great. If the patient is excessively fat,
one will then naturally do a regular lipectomy operation, such
as I have described in my previous article. This serves the
same purpose and is done the same as the lesser procedure
here described. I wish, however, here to emphasize the value
of removing wedges of skin and fat in patients who are not
troubled with obesity, but simply and solely for getting rid
of a part of the thickness of the abdominal wall and making
the field of the operation more accessible.

An oval or an elliptical excision is made such as that
figured (Figs. 1 and 2), cutting right down to the strong
fascia overlying the rectus and oblique muscles. All bleeding
vessels ought to be carefully tied. It is a good plan, I think,
to slope the edges of the incision a little inwards. When this

piece of skin and fat is removed the operator then finds it much easier to open the abdominal wall and operate than in a similar case where he has to retract this embarrassing mass of tissue as well.

I like to close such a wound with a fine catgut suture, catching a distinct layer of fascia about the middle of the fat, silkworm gut sutures uniting both skin and fat.

SUPERNUMERARY KIDNEY SUBJECT OF CYSTADENOMA.

BY FARRAR COBB, M.D.,

AND

HAROLD G. GIDDINGS, M.D.,

OF BOSTON, MASS.

THE case reported is unique so far as the writers have been able to find. Cases of supernumerary kidney in themselves are very rare. We have found recorded in all literature but seven such, and in two of these the extra kidneys were fused with one of the normal ones. The rarity of the condition makes the case distinctly worthy of presentation, the more so because the supernumerary organ was not only well developed, which was true in none of the other cases, but because it revealed a pathological condition (papillary cystadenoma) distinct, definite, and in itself comparatively rare as a form of renal tumor.

The operation which revealed this unusual pathological condition was undertaken for the removal of a very large abdominal tumor the nature of which was uncertain before the operation.

CASE.—G. R. F., June 25, 1909, sixty-seven years, married. Carriage driver. Born in Maine where he has always lived.

Family History.—This contained nothing of importance except the following curious statement: the patient was one of twin brothers, the other of whom had died and at the autopsy was found to have only one kidney. The cause of death in the brother's case was not known, and verification of the facts was impossible.

Past History.—Unimportant.

Present Illness.—About two years ago, while "rolling a

trunk," patient was seized with a sudden, severe pain on the left side of the abdomen extending into the flank. This soon passed off, but left him feeling weak for a number of days, and soon after he noted a "bunch" on the same side. This has been present constantly since that time, but not always of the same size; has been larger at night than in the morning, and apparently larger after its possessor had been working. Pressure of gas in the intestines makes it "feel big." The tumor is painful when the bladder is full and there is a sense of pressure on the growth. Voiding of urine gives some relief, but there remains afterward a slight soreness about the tumor; the voiding of urine does not, however, reduce the size of the swelling. The urine has always been clear. At no time have there ever been any other urinary symptoms.

Physical Examination.—A tall, rather spare man; color good; no evidence of cachexia. No glandular enlargement anywhere.

The entire left half of the abdominal cavity and about one-half of the right portion was occupied by a tumor mass, the longest diameter running diagonally from left to right, and from above downward. The tumor was firm, somewhat elastic, not notched, smooth, flat to percussion, slightly tender when firmly pressed down, and did not change its relative position when the patient changed his. It did not move with respiration; it gave no fluid wave. It was impossible to get well in behind the mass. There was no tenderness in the costovertebral angles. The veins in the abdominal wall over the mass were enlarged; the picture resembled that of a large ovarian cyst, as a distinguished German surgeon, who examined the case before operation, facetiously remarked. When the stomach and colon were inflated they were found lying over the tumor.

Urine: Normal color, acid. Specific gravity 1030. No sugar; no albumin. Nothing in the microscopic examination.

Blood: White count 15,000. Stained specimen normal. Differential count: polymorphonuclears 67 per cent., lymphocytes 32 per cent., eosinophiles 1 per cent.

Diagnosis.—Before operation the diagnosis was uncertain. It was impossible to differentiate between a large cyst of the pancreas, a mesenteric cyst, a tumor of the kidney, or some new growth from the retroperitoneal glands. It seemed fair to

assume that the tumor was retroperitoneal, and the diagnosis of choice was pancreatic cyst.

Operation.—This was done by Dr. Cobb at the Massachusetts General Hospital on June 29, 1909. A six-inch incision was made in the median line. The tumor was found to be retroperitoneal. The overlying peritoneum was opened, a trocar inserted into the growth but nothing obtained. An incision was then made into the mass, and after a large amount of necrotic, grumous material had been removed, it was discovered that the growth was in the main a cyst filled with dark, thick fluid and débris, but that this cystic portion sprang from a solid mass which resembled a kidney.

The mass lay beside the inferior vena cava, to which it was closely adherent and from which it was with great difficulty freed. No ureter could be found. After complete removal of the growth, a large gauze drain was left in and the wound closed in layers. When, from the gross appearance at the operation, it seemed probable that the tumor was a cyst containing kidney tissue, careful search for the right and left kidneys was made with the result that both were seen and palpated.

Pathological Report.—Dr. F. C. Kidner, one of the pathologists at the Massachusetts General Hospital, made the following written report:

"A tumor 18 cm. in its greatest diameter. Included in one side of the wall is a flattened, rather enlarged kidney which on section is apparently normal. The tumor evidently had grown from one pole of the kidney. No ureter is to be made out. On opening the tumor it is found to consist of a sac of fibrous tissue entirely filled with a granular cellular mass apparently without structure. At the periphery a certain amount of this cellular material is adherent, and evidently grows from the capsule. This is also true on the kidney side, where the growth sprouts directly from the kidney substance. The material in the mass is yellowish and seminecrotic in character.

"*Microscopic examination* of a piece removed from the junction of the kidney and the tumor shows kidney tissue largely replaced by connective tissue and markedly inflamed. Growing from this is a mass of vascular, papilloma-like tissue, suggesting, under the lower power, papillary cystadenoma.

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Under the higher power the growth appears as single layers of cells covering on both sides stalks of fibrous tissue, each of which carries a small blood-vessel. The individual cells are of the low columnar type, with slightly ovoid vesicular nuclei, and evidently belong to the epithelial series. Mitotic figures are extremely common.

"*Diagnosis.*—Papillary cystadenoma of the kidney."

In Fig. 1 the kidney tissue with the distinct glomeruli can be seen, and in Fig. 2 is shown the border line between the renal tissue and the fibrous structure of the new growth.

This case is of particular interest because the third kidney was fully developed; because the other kidneys were both seen and felt, which is not true of all the other cases reported; because it had its own separate blood-vessels, but lacked a ureter, and because of the pathological condition for which the operation was done. One and a half years after the operation the patient was in excellent condition and able to do his work as a driver of carriages.

Quain's "Anatomy," tenth edition, makes casual mention of the fact that the occurrence of additional kidneys is extremely rare, but that they may appear either on one side or the other of the vertebral column or in the pelvis. A few cases of supernumerary kidney have been reported.

WATSON CHEYNE reported a case, which in some respects resembles that of the writers. Cheyne says that the supernumerary kidney was discovered during a laparotomy, it was structurally well developed, was situated in the right side at the lower part of the spinal column just above the pelvic brim three or four inches below the normal kidney on that side, and was freely movable and had its own ureter and blood supply. Cheyne's opinion was that the symptoms of abdominal pain and indigestion, for which his operation was undertaken, were caused by the mobility of this supernumerary kidney.

DEBIÉRRE related a case of Gavard's where there were three kidneys situated over the lumbar spine and the ureter of the central kidney opened into the ureter of the right. This extra kidney was a small pear-shaped body near the upper margin of the left kidney. It had a distinct ureter, which entered the regular one on the same side about half an inch below the latter's exit from its kidney.

In a case reported by the Surgeon-General of the Marine-Hospital Service, a miniature kidney occupied the hilum of the left kidney, being

Fig. 1.
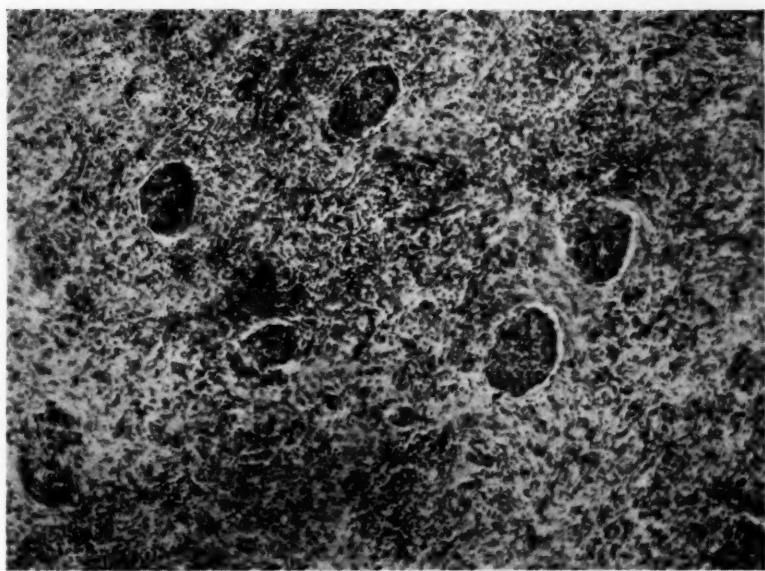
Section from that part of the tumor which resembled normal kidney tissue, showing glomeruli.

Fig. 2.
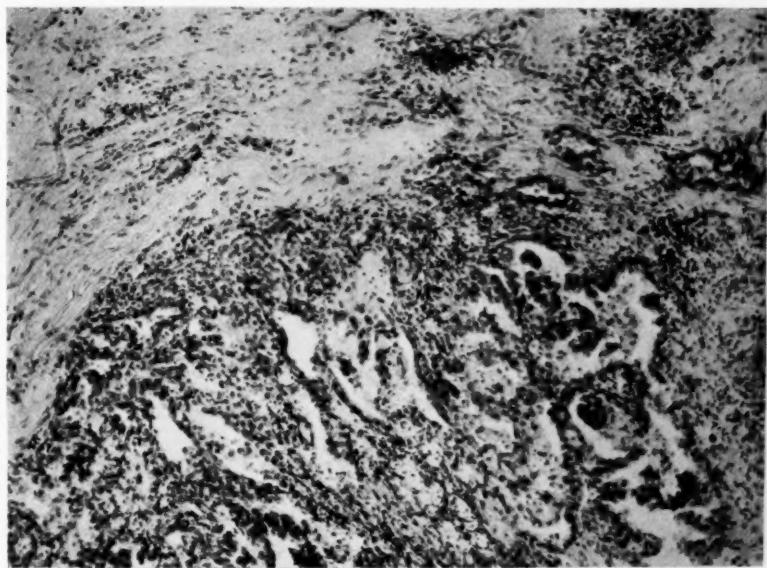
Section showing boundary zone between normal kidney tissue and the capsule of the cystadenoma.
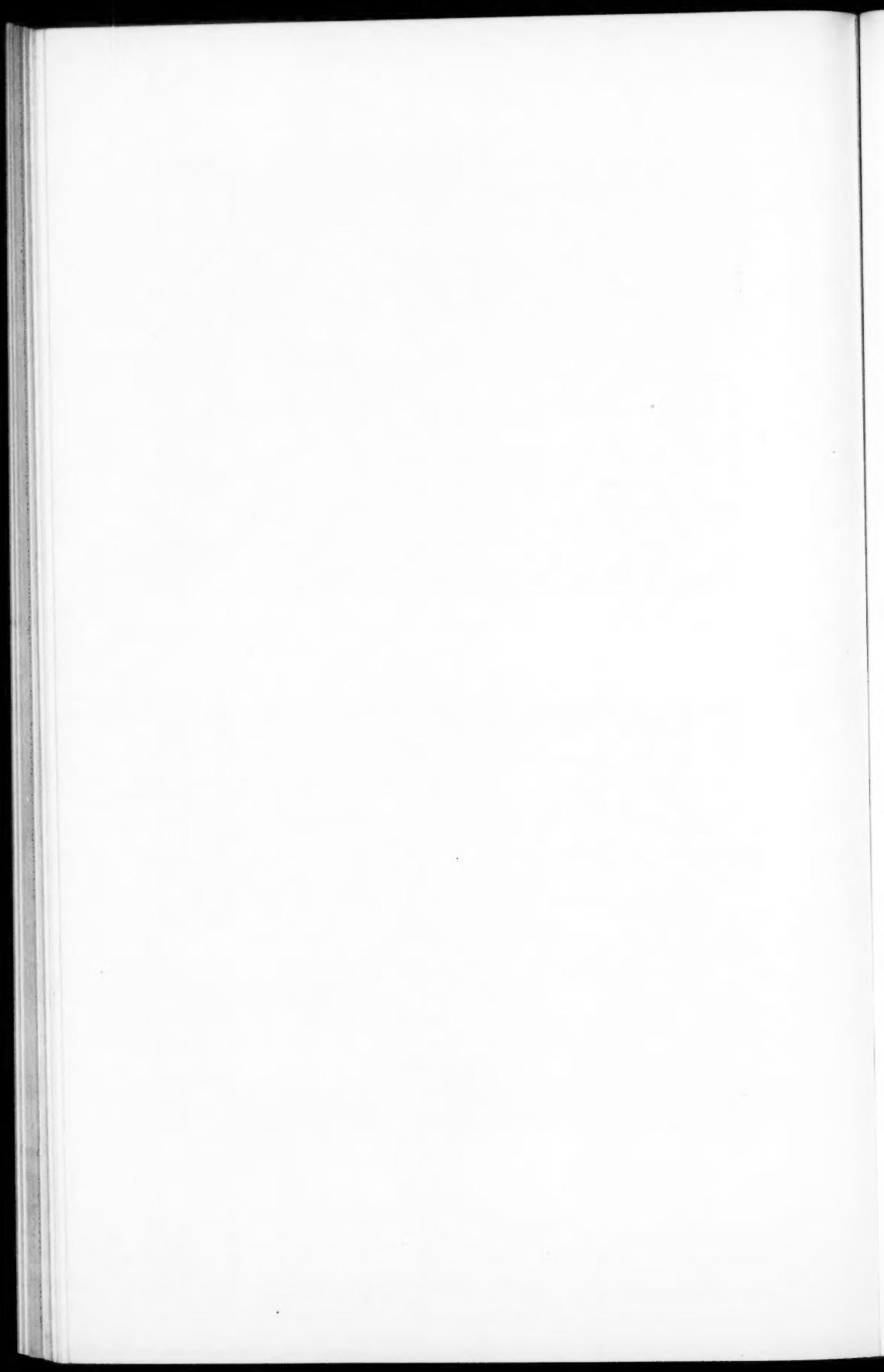
supplied with a short ureter which ran into that of the parent organ. It was three-fourths of an inch long and half an inch wide, and weighed about 1.5 grammes.

NEWMAN has reported an instance of supernumerary kidney found postmortem in a male subject who had died of malignant disease of the colon. It was a small pear-shaped body lying close to the upper margin of the left kidney, receiving its blood supply from a branch of the renal artery, and possessing its own distinct ureter, which passed into the left ureter half an inch below the pelvis of the left kidney.

BARTLETT reported an instance of supernumerary kidney. Two kidneys on the left were fused together, though each had its own ureter arising separately from its own pelvis and continuing so to the bladder, one entering it a quarter of an inch above the other. On section a distinct demarcation of the two kidneys was not visible to the naked eye; all three were normal in appearance.

TSCHUNDY has placed on record a case of complete double formation of one kidney, the upper portion of which was distended and septic, the lower part being perfectly normal.

MUNRO and GODDARD reported in 1907 a case of " Pyelonephrosis of a Supernumerary Kidney " in which the patient, a young man of twenty-three, had had indefinite abdominal symptoms from the time he was three months old up to the age of eighteen years. From then for the next five years he was free from symptoms, at the end of which time they forcibly returned, together with a large tumor. Operation was undertaken in two stages. A cystic condition was relieved by drainage, and later a sac was dissected out from the pelvis where it lay attached by a ureter to the bladder. It was first thought to be a cyst of the urachus, but the pathological report stated that the tissue consisted of a cyst lined with stratified epithelium similar to that in the pelvis of the normal kidney. The thicker portions of the wall were composed of easily recognized renal tissue, containing numerous glomeruli, separated from one another by masses of tubules. In these places the amount of connective tissue between tubules corresponded to that of normal kidney. For the most part the tubules did not show normal epithelium, though occasionally they did. The whole picture was one of hydronephrotic kidney.

This case of Munro and Goddard's in certain respects resembles that of the writers'; in each instance there existed a large cyst, though in the one presented here there was apparently much more kidney tissue than in the other, for in the latter, the nature of the growth was not recognized until the pathologist's report had been obtained, whereas, in the writers' case, as already pointed out, the cyst grew from a supernumerary kidney, which grossly as well as microscopically resembled a normal one.

In Munro's case both right and left kidneys were not seen or palpated. The presence of the right was determined by X-ray photographs after operation. Although there can be little if any doubt that two other kidneys were present in this case, it would have been more satisfying if other proof than X-rays could have been obtained. Munro and Goddard did not suspect the renal origin of the cystic tumor, whereas in the writers' case it was apparent during the operation that an anomalous kidney was connected with the tumor.

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THE DAMAGE DONE TO THE KIDNEY BY OPERATION.*

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At a meeting of this Society last year, a paper was read upon essential hemorrhage of the kidney,[1] in the discussion of which a great variety of technical methods was described, and during which the question naturally arose, " How much is the function of the kidney interfered with by the various operations advised, and of these operations which does the least damage? " The present paper reports an effort to answer these important questions by experimental deduction.

With our present excellent surgical technic, we are able to operate upon all of the organs of the body usually without causing the immediate loss of the patient's life. The tendency is, therefore, to perform some very heroic operations, many of which doubtless do great damage to the organs. Especially is this true when operating upon the kidney. We can remove one kidney and have the patient live, but it is yet to be demonstrated that the health or life expectancy of a person with one kidney is as long as it would be if he had two. We question whether any life insurance company would insure a person who had had one kidney removed, even if it had been removed on account of traumatism.

To take up in more detail the question of operation wounds of the kidney: at least two general routes for kidney exploration are possible, first, section of the pelvis (so-called

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* Read before the Academy of Medicine in Minneapolis, Oct. 7, 1910.
[1] ANNALS OF SURGERY, vol. xlix, p. 618.

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pyelotomy) and second, section of the kidney substance (nephrotomy).

The tendency of the epithelium of the normal pelvis of the kidney to proliferate enormously when cut and continuously irritated deters somewhat from this route of exploration. As an example, in a pyelotomy done by one of the authors on a dog, the proliferated epithelium resembled a malignant growth. Pease states that some such epithelial proliferation is the rule when the normal pelvis is opened, and in one of the animals operated by Pease the pelvic epithelium proliferated to such an extent as to line the entire wound with squamous cells, producing a permanent fistula. While this is probably less apt to occur in a pelvis in which the epithelium has been extensively damaged by long-continued irritation, such as might result from a large stone, this objection yet remains for exploring the kidney with a nearly normal epithelium lining the pelvis. The flap of fatty tissue recommended by Mayo has somewhat lessened the chance of fistula.

Pyelotomy, according to Eisendrath, Perineau, and others, is limited to cases in which there is no infection and in which there are no very large stones.

Nephrotomy, on the other hand, always results in some destruction of kidney substance. However, the operation of nephrotomy cannot be entirely done away with. For this reason experiments were undertaken to ascertain the amount of damage done to the kidney by various methods of kidney suture, together with a study of the loss of function resulting from such procedure. The work was done entirely on the kidneys of rabbits. *All animals operated on were under full ether anæsthesia.* Incisions were made from pole to pole in the median line, extending through the kidney substance. These were sutured by one of the following methods:

1. Continuous suture of the capsule only.

2. Continuous mattress sutures, in which the suture material was introduced parallel to the cut and this procedure repeated until the tissues were approximated.

FIG. 1.

Kidney sutured by Method I. This figure shows large accumulation of blood about sutured kidney, occurring between the peritoneum and the muscles of the posterior abdominal wall.

FIG. 2.

Kidney sutured by Method II. Transverse section cut at right angles to long diameter. The gross changes indicate only a part of the actual damage to the tissue.

FIG. 3.

Kidney sutured by Method II at the end of 37 days. The scar has become sufficiently old to cause shrinkage and deformity of kidney. Size of kidney about two-thirds that of normal.

FIG. 4.

Transverse section of kidney operated on by Method III. Shows narrow and sharply defined infarct as it occurred ten days after suture.

FIG. 5.

Kidney sutured by Method III. Result of too tight ligatures.

FIG. 6.
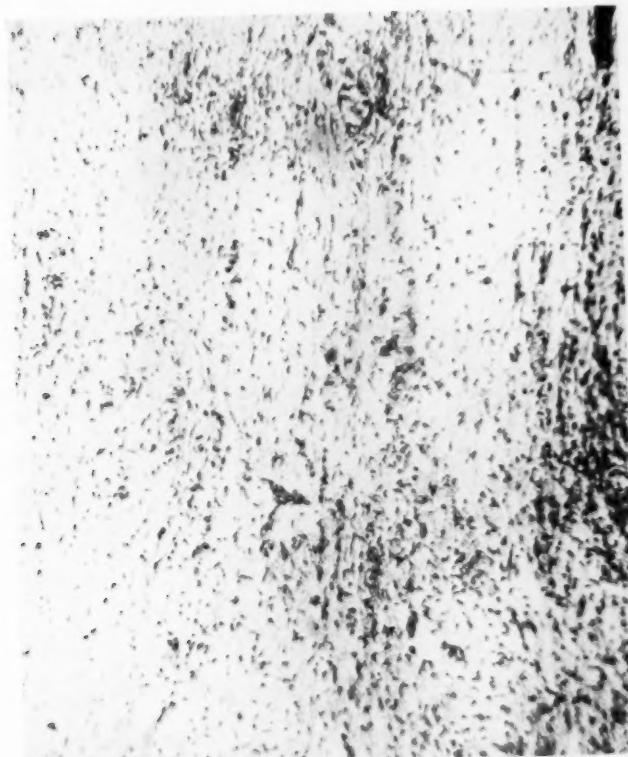
Section of infarct occurring in kidney sutured by Method II. This consists of newly formed connective tissue originating from the capsule.

FIG. 7.
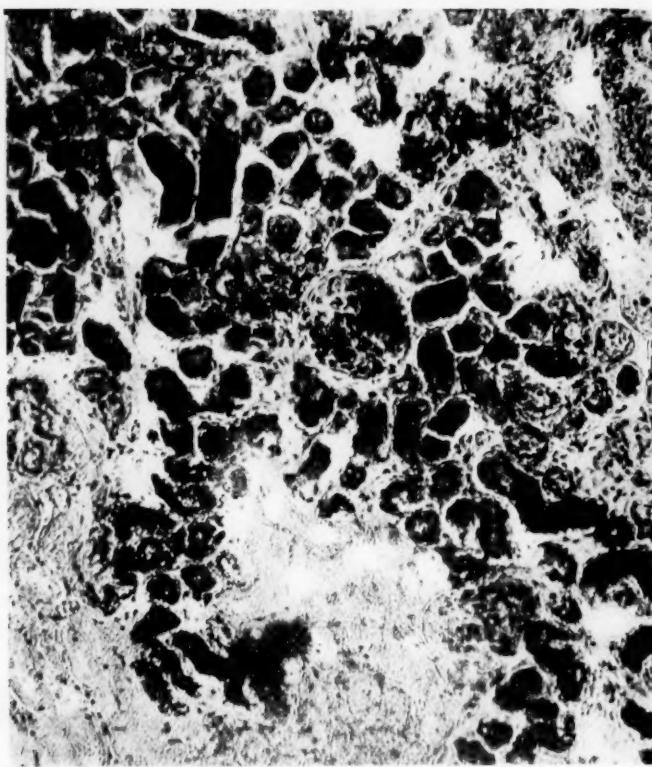
Kidney sutured by Method II at the end of 37 days. Shows degenerated tubules in scar. Also a single surviving glomerulus.

FIG. 8.

Kidney sutured by Method II at the end of ten days. The damage extends far beyond tissues between two catgut sutures seen in picture.

FIG. 9.
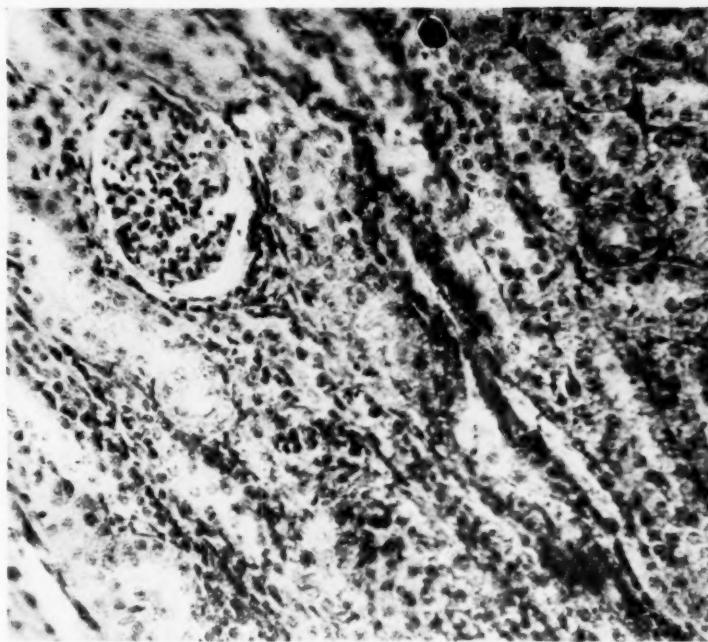
Kidney sutured by Method II at the end of 90 days.   Remote from region of suture.

FIG. 10.
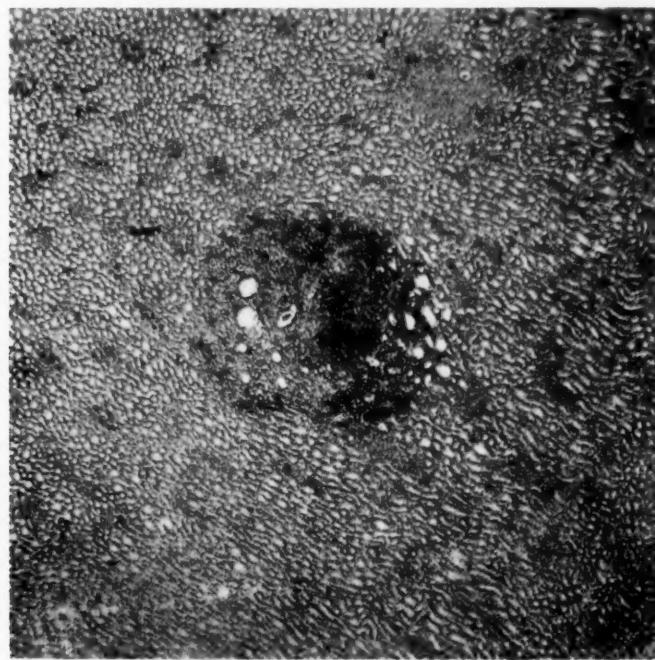
Kidney sutured by Method III.   Shows extent of damage done by ligature used
to transfix kidney.

FIG. 11.
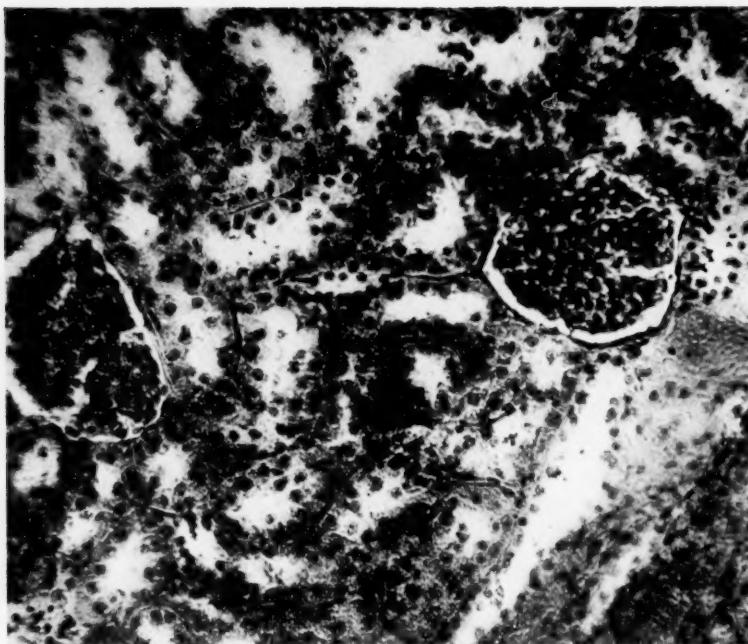
Kidney sutured by Method III. Appearance of kidney remote from sutures.

FIG. 12.

Transverse section of kidney sutured by Method III at end of ten days.

FIG. 13.
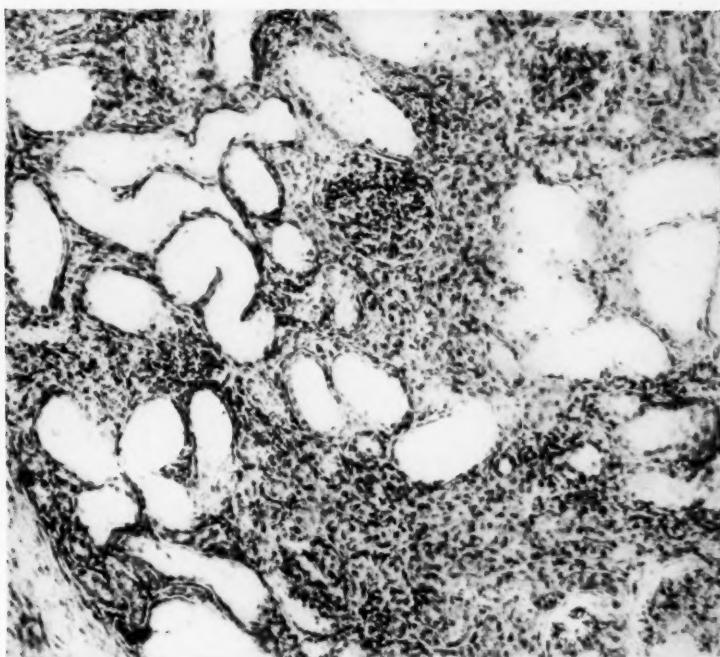
Kidney sutured by Method II at the end of 90 days. Portion of kidney remote from line of suture.

FIG. 14.
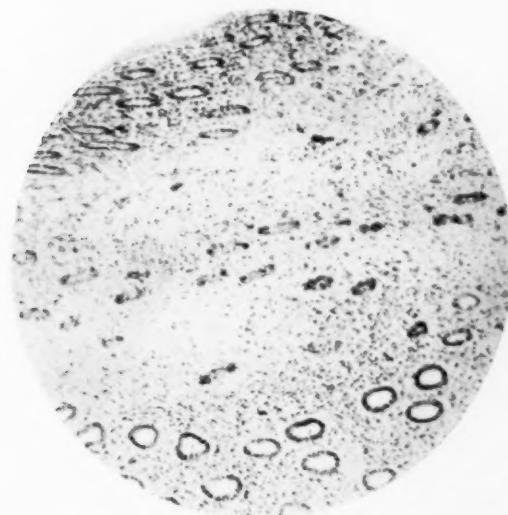
Masses of epithelial cells found in the scar of kidney operated upon by Method II at end of 37 days. These resemble in every way new formed tubules.

FIG. 15.
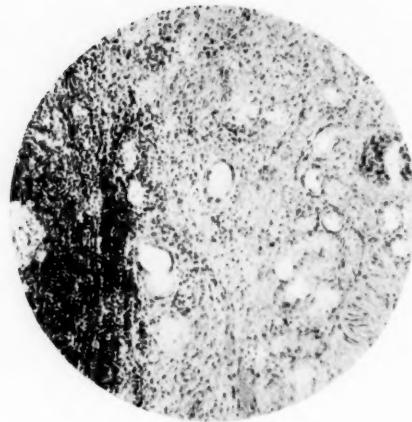
FIG. 16.
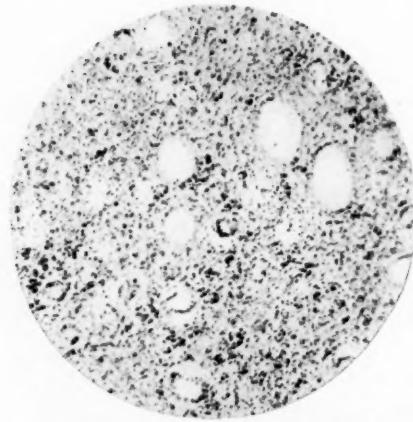
Sections showing the formation of cysts from cell masses occurring in the scar of a sutured kidney after 37 days.

FIG. 17.
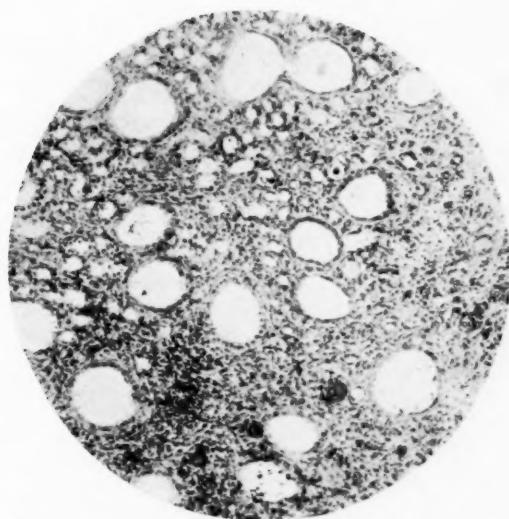
Section showing the formation of cysts from cell masses
occurring in the scar of a sutured kidney after 37 days.

FIG. 18.
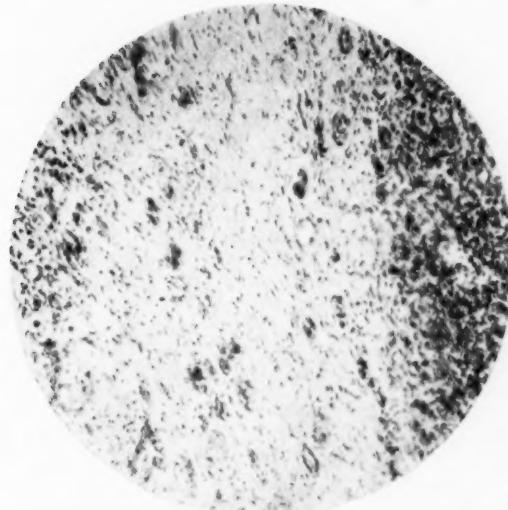
Section showing atrophic change in the cell masses included
in the scar of a sutured kidney 37 days after operation.

FIG. 19.
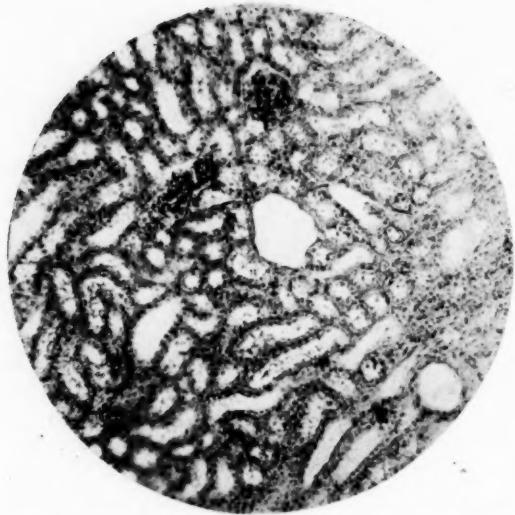
Section taken at the margin of scar occurring in kidney
sutured, Method III, at end of 37 days.

3. Interrupted sutures transfixing the kidney at the pyramidal line and tied around the body of the kidney. Three sutures were usually used in the case of rabbits, great care being taken to employ only enough tension to coapt the cut surfaces. The operated animals were killed at the end of 10, 37, and 90 days, and the kidneys carefully studied.

METHOD I.—In the experiments in which the capsule only was sutured, in two instances large and fatal hemorrhages occurred soon after the operation. The result of this hemorrhage is shown in Fig. 1, as seen from the peritoneal side. As the essential function of the suture is to control hemorrhage, a simple suture of the capsule does not recommend itself.

METHOD II (Mattress Suture).—In the second method, both single and double nephrotomies were performed. In the single nephrotomies at autopsy great disparity in the size of the kidneys was noted. At the end of ten days the average weight of the operated kidney was found to be seven grammes, of the unoperated kidney twelve grammes. This apparent compensatory hypertrophy was carefully studied, and the following conditions were noted in the intact kidney where a nephrotomy had been done on its fellow: there was no demonstrable increase in the number of glomeruli, the blood-vessels were dilated and somewhat larger than normal, and Bowman's capsule was separated by a considerable space from the glomerular tufts. These findings suggest congestion rather than kidney reproduction.

The sutured kidney cut at right angles to the line of suture showed a large, wedge-shaped infarct including over one-third of the kidney substance. This at the end of ten days is shown in Figs. 2 and 8. On microscopical study it was found that the damage to the kidney was much more wide-spread than the gross lesion indicated. On histological examination of such a kidney ten days after operation, the infarct apparent in the gross section was found to be composed of necrosed kidney substance (Fig. 7), surrounded by connective-tissue cells that had grown in from the capsule (Fig. 6). Outside of this infarct was a sharp transition to a second zone, in which were seen dilated tubules occasionally having some exudate in the lumina, flattened glomeruli with thickened capsules, swollen convoluted tubules, and considerable connective tissue.

The histological study of the kidney remote from the line of suture showed the glomeruli dilated and surrounded by hyaline masses of degenerated capsular cells. The tufts in other places did not fill their capsules. The number of glomeruli was apparently diminished. Convoluted tubules were increased in size, and conducting tubules were dilated and deformed. In areas there was considerable lymphoid cell infiltration.

The gross deformity of the kidney increased with time after this operation. Fig. 3 shows a transverse section through an operated

kidney at the end of thirty-seven days. In this may be seen completely formed scar tissue. The most striking feature in the sections taken at this stage of repair was the occurrence of masses of epithelial cells in the scar tissue. These showed evidence of active proliferation, and resembled in every respect the straight tubules. This tendency toward regeneration of parenchyma is but short-lived, however, for in portions of the same kidney we found these masses surrounded by scar tissue, beginning to show cystic and atrophic changes (see Figs. 14, 15, 16, 17 and 18).

At the end of ninety days there was a dense connective-tissue scar at the site of the operation. In this there were only remnants of straight tubules with but a semblance of their original histological detail. The glomeruli in the second zone were often surrounded by a marked lymphoid infiltration. In portions of the kidney remote from the incision there was much deformity of the kidney tubules, with a large amount of connective tissue (see Figs. 9 and 13).

Experiments are being done to determine the nitrogen output after operation by Method II. In these experiments a nitrogenous equilibrium is first established, the animals are then operated, the urine collected at various periods of time, and analyses made.

The protocols of these show great variation in the amount of nitrogen excreted by operated animals. Taking the work of Pearce, who has shown the effect of reduction of kidney substance on nitrogen output, as a basis, we are led to believe that a large part of the functionating kidney, as far as the excretion of urine is concerned, has been lost. Evidences of any loss of function depending upon internal secretion are wanting in our experiments. This apparent chemical corroboration strengthens our belief in the histological demonstration that great damage has been done.

METHOD III.—In the kidneys operated on by Method III, in gross transverse section only a very narrow and sharply defined infarct appeared on the tenth day (Fig. 4). On histological examination the damage done seemed to be nearly confined to this small area of infarction (Fig. 19). In addition to this, however, there were damaged areas in the remote portions of the kidney made by the needle puncture. That the destruction of tissue from these ligatures was very slight may be seen in Fig. 10. The apparent ingrowth of the straight tubules and the other histological changes in the immediate region of the incision were much the same as in the last method, but were much less extensive. The remote portions of the kidney maintained a nearly normal condition except for the lesion suggesting congestion (Fig. 12). There was no

general connective-tissue production such as occurred in the cases operated on by Method II.

When a single kidney was operated on by this method, the remaining kidney increased in weight but to a very slight degree, from 7.5 to 9 grammes, while the increase in Method II was from 7 to 12 grammes. The protocols on the nitrogen output confirm the histological findings.

In the kidneys removed several months after this operation, in some instances only a slight line of scar tissue remained, accompanied by very little deformity. In this method much depends on the technic employed. Where excessive tension is used (Fig. 5), or where the tissues are traumatized to a considerable degree, as serious lesions follow this method of suture as do the preceding method, but with careful technic excellent results are obtained.

To recapitulate, these experiments clearly demonstrate:

First, that an operation upon the kidney always destroyed some kidney substance.

Second, that the section of the kidney did less harm than the suturing necessary to control hemorrhage.

Third, that suture of the capsule alone was not sufficient to control the hemorrhage and is therefore dangerous.

Fourth, that mattress sutures destroyed a great deal of the kidney substance, and that the enlargement of the un-operated kidney after a short time was due to congestion from overwork and not to increased kidney substance, showing that the sum total of kidney substance is reduced by an operation.

Fifth, that the destruction of kidney substance extended far beyond the field of operation.

Sixth, that the functional activity of the operated kidney was somewhat reduced, and this resembles the finding in a contracted kidney due to other causes.

Seventh, that interrupted sutures transfixing the kidney at the pyramidal line and tied around the body of the kidney did the least damage, and this method therefore is the method of suture to be recommended.

Eighth, the use of a figure eight suture penetrating the capsule only has been suggested by Dr. John W. Draper Maury in discussing this paper. Experiments are now being done to show the result of such a suture.

EMPYEMA OF THE URETER.

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THE question has been raised whether or not the persistence of normal contractions in the ureter following a supposedly complete removal of the kidney of the corresponding side is evidence of some remaining kidney substance.

In the course of a cystoscopic examination, in cases of grave unilateral renal lesion, one not infrequently observes that the trigone on the affected side remains motionless, the ureteral opening is rigid, and nothing is seen to escape from the ureter. The difference in the appearance of the two sides of the trigone is often pronounced. The contrast is particularly striking when indigo carmine has been used. Jets of deeply colored urine escape from the normal opening at frequent intervals and with force. The opposite side remains at rest and nothing escapes from the opening.

This phenomenon I have observed many times in cases of stone in the pelvis of the kidney, stone in the ureter, unilateral tuberculosis, and in one case of a large abdominal tumor which pressed upon and completely occluded the lumen of the right ureter. It is natural to suppose that the removal of a kidney, which throws out of function the ureter on that side, is followed, in the course of time, by atrophy of the latter. That this is true seems evident from the literature, which contains, so far as I know, no mention of the persistence of contractions in such a ureter. This applies to cases of simple nephrectomy where the ureter is not dilated or badly diseased. In a case of nephrectomy where the ureter which is left behind is dilated or badly diseased, or possibly contains a stone which was overlooked, the conditions are quite different. It is possible, under such circumstances, that the presence of infection or of a

foreign body may be sufficient to keep up irritation in the ureter and cause a persistence of peristaltic contractions, even after the complete removal of the corresponding kidney.

The following observation is unique in my experience and is of interest as bearing upon this particular question. The case is reported in detail as it presents other points of considerable interest. I have seen no mention in the literature of a similar observation. The history of our patient follows:

Wm. S., aged 41, physician. His health was good up to 1895. At this time he developed the first symptoms referable to the urinary apparatus. He first suffered with chills and fever, which were thought to be due to malarial fever. Associated with these attacks, however, was considerable pain in the left kidney region. In 1898 he noticed that the last few drops of urine were whitish and contained gritty material. In 1900 he passed the first stone *per urethram.* At this time he was suffering from typical attacks of renal colic. After such an attack, on the same day or following day, he would pass a stone from the bladder. These attacks were repeated at intervals of a few weeks up to 1905, when he passed a stone from the kidney too large to escape from the bladder. Litholapaxy was done under ether, and material weighing five grains was removed. A few days later a second crushing operation was performed to remove a portion of the stone left at the first séance.

In 1906 he had a severe attack lasting six days, and followed by the escape of a "quart" of pus from the bladder. A few days later a stone became impacted in the perineal urethra and had to be removed by perineal section. Two days after this operation, another calculus was caught in the urethra, but was finally removed by the use of cocaine and oil. He continued to pass stones at intervals up to 1907, when he first came under my observation. I was asked to see the patient in consultation to determine the condition of his kidneys. A cystoscopic examination revealed a left pyonephrosis, pus was squeezed from the ureteral opening with each contraction of the ureter in the form of a round, worm-like mass. An X-ray examination disclosed a calculus in the left kidney and another in the upper portion of the left ureter.

Further notes on my examination at that time have been lost, but evidently the right side was normal, as nephrectomy was advised and accepted. Dr. Balloch, of Washington, removed the kidney, which was so large as to require resection of the last rib for its removal. The ureter was greatly dilated to a tube fully 1.5 cm. in diameter. It was ligated and the stump cauterized. No attempt was made to remove it as the patient's condition did not justify any further interference, and the presence of the calculus in the upper portion of the ureter was overlooked. The secreting substance of the kidney was completely destroyed, and the whole transformed into a pus sac enclosing a large phosphatic calculus. The calculus was enveloped by a quantity of thick, creamy material and masses of thicker, firmer débris too large to pass the dilated ureter.

Since this operation in 1907 the patient has been free from symptoms referable to the kidney or bladder, except for the passage of blood-tinged urine on one or two occasions during 1909. He has had no attacks of renal colic, and has passed no stones. He came under observation again in February, 1910, when he was admitted to the hospital suffering with anuria. He then stated that on February 1, he began to suffer with general muscular pains and severe headache lasting four days, but with no symptoms referable to the kidney. On February 14, complete anuria developed. He was admitted to the hospital at the end of the third day of complete anuria. At that time he was drowsy, stupid, and complained of severe headache and deep pain in the right loin. On the following morning, while preparing him for cystoscopy, he passed 500 c.c. of urine, the first urine voided in three days.

Cystoscopy revealed a badly inflamed bladder, particularly marked over the base, but no ulcerations were seen. The picture presented by the ureteral orifices was most striking. From the right ureter a worm-like plug of pus was escaping, being forced out by each contraction of the ureter, and coiling up on the base of the bladder. This plug completely filled the orifice of the ureter so that no urine escaped. Turning now to the left side of the trigone, an exactly similar picture was seen. The orifice was completely filled by a plug of pus which extended to the floor of the bladder in unbroken continuity, where it was coiled up like a worm. In watching the orifice, the ribbon of pus was seen

to be extruded intermittently with each contraction of the ureter. As no urine was escaping from the right side to cloud the field, opportunity was offered for a prolonged inspection, and to demonstrate the striking, and to us unique, condition to several members of the staff present. The ureter on the left side continued to expel the worm-like mass of pus intermittently with each contraction during the whole time of the examination, which was purposely somewhat prolonged. It was evident the anuria was produced by the complete plugging of the right ureter by a plug of pus too thick to permit its ready escape. Pressure was therefore made over the right kidney. Immediately there was a rapid escape of the plug of pus, resembling in a striking way the escape of ointment from a collapsible tube when pressed upon vigorously. This lasted for a considerable time and was followed by a gush of urine and pus which soon obscured the field.

Following the cystoscopy, the patient passed a large quantity of urine, over 100 ounces during the next twenty-four hours. The temperature, which rose to 102 on the morning of the examination, fell to normal in the evening. The leucocyte count on that date was 10,600. For several days his condition was much improved, the kidney drained well, but pain in the region of the remaining kidney persisted. On February 23 he complained of uneasiness in the bladder and penis, as though a stone were present in the bladder. A second cystoscopy revealed the same condition of the left ureter as just described. Pus was also escaping from the right side, together with considerable urine, but it was evident that drainage was not free. There was an irregular mass lying on the trigone just behind the internal urethral orifice, white in color, and looking like a mass of pus which had escaped from the ureters. An X-ray examination of the kidney was negative for stone. He voided no urine from 5 P.M. of the twenty-third until 4.45 P.M. of the following day, when he passed only 10 ounces. The temperature at that time was 101.2, pulse 100. He did not void again until midnight, when he passed four ounces. No more urine was voided nor was any obtained by catheter before operation, which took place on the morning of the twenty-sixth, although repeated attempts were made to free the ureter by massage over the kidney and along the ureter. At the time of the operation the temperature was 97 and the patient was complaining of severe pain in the right kidney.

Operation (Feb. 26, 1910).—Under local anæsthesia the kidney was exposed through the usual oblique incision. The fatty capsule was very thin, and the kidney was found directly under the incision. Chloroform was now given, and the operation continued while the patient was going under the anæsthetic. The kidney, which was tremendously enlarged, was readily exposed by stripping off and pushing forward the peritoneum. It extended far up under the ribs, and the lower pole reached far down toward the pelvis. No attempt was made to deliver the organ, as this was not necessary, and could not have been done without first having opened and drained it. No attempt was made to control hemorrhage by compressing the pedicle, as there was such tremendous distention of the organ as to make hemorrhage unlikely. A large trocar was first introduced, urine mixed with pus spurting out with great force. The opening was then rapidly enlarged by stretching and the cavity explored by the finger. No stone could be felt, but the cavity was so large that the exploring finger could not easily reach all parts of it. The secreting substance of the kidney was reduced to a mere shell of parenchyma less than one centimetre thick. After thoroughly washing out the cavity, a large drainage tube was inserted for drainage and the wound closed. Very little chloroform was used and the patient reacted well.

During the first twenty-four hours 109 ounces of urine drained through the tube. The tube slipped out of the kidney wound and was removed at the end of twenty-four hours. During the second day 147 ounces of urine was voided naturally, while 128 ounces passed the third day. Practically no urine escaped into the dressings, due, no doubt, to the collapsing of the distended kidney and the shutting off of the nephrotomy wound. Recovery from the operation was rapid. The patient walked out of the hospital on the twenty-third day.

On March 10, twelve days after the operation, he stated that the stone which he had felt in the bladder before the operation had passed into the urethra and was being forced out with each urination. A stone about an inch long could be felt in the perineal urethra. Attempts to milk it forward were unsuccessful, but it was slowly forced out by the urine until it finally caught at the fossa and was removed by the patient himself with a pair of thumb forceps. This stone was pure white, very soft, breaking

up on the slightest pressure, and was little more than a mass of phosphatic sand, loosely adhering and moulded into the form of a calculus by the urethra.

Two days after leaving the hospital, another stone became impacted in the prostatic urethra, and was so effectually blocking the channel as to prevent the escape of urine. This was readily pushed back into the bladder with a Porges catheter and a large amount of residual urine withdrawn. This stone was later crushed at the office under cocaine anæsthesia and the fragments completely removed at the first sitting.

His present condition is good. He is going about attending to his practice, feels well, is voiding a large amount of urine, and looks the picture of health. The urine is pale, turbid with pus, acid, specific gravity 1006, and contains more albumin than can be accounted for by the pus present. Indigo carmine is eliminated in exactly fifteen minutes, coloring the urine a deep blue. Twenty minims of 1 per cent. solution of phloridzin were injected. A positive test for sugar was obtained in fifteen minutes. The urea is low in the single specimen voided at the office.

Summary.—Our patient gives a history of calculous diseases of fifteen years' duration. The onset was marked by symptoms referable to the kidney. He has passed a great many calculi. Perineal section was performed for an impacted calculus in the urethra. Another stone was removed from the urethra by milking it forward to the meatus. Two litholapaxies were performed. The left kidney was removed on account of calculous pyonephrosis. Empyema of the left ureter developed as a result of the presence of a calculus, which was demonstrated in the first X-ray examination. This calculus was forgotten and consequently overlooked at the time of the left nephrectomy. Infection of the right kidney took place, pyonephrosis developed, and complete anuria occurred suddenly three years later. Anuria was complete for three days, and was due to the plugging of the ureter with pus. Renal retention was partially relieved by massage of the kidney and along the ureter, thus dislodging the plug of pus filling the ureter. Anuria again developed and nephrotomy of the remaining kidney was done. This kidney was greatly distended with urine and pus. No stone was demonstrated by the X-ray and none found at the operation. The parenchyma formed a mere shell of tissue less than one centimetre thick. Recovery

was prompt and complete. Since the operation the patient has passed one stone and another has been removed from the bladder by litholapaxy. The X-ray plate now shows a stone in the left ureter of the same shape, size, and location as shown in the plate taken three years ago. Normal peristalsis was observed in this ureter three years after the complete removal of the corresponding kidney.

REMARKS.—Infection of the ureter as a sequence of kidney infection is common. Removal of the diseased kidney is followed, in the majority of cases, by the disappearance of the diseased condition in the ureter. Empyema of the ureter following nephrectomy, is, therefore, rare, but does occur, and is usually due to a stone in the ureter, as in our case. Israel reports a case of empyema of the ureter following nephrectomy, and states that he has seen this complication only four times in 900 cases of total extirpation of the kidney. In his case a stone, which was overlooked at the first operation, was present in the vesical end of the ureter.

The persistence of peristalsis in a ureter following a complete nephrectomy must also be extremely rare. I have seen no observation of this kind reported in the literature. In Israel's case above referred to, the diagnosis was made by the cystoscopic picture, pus escaping from the ureteral opening. The report does not state, however, whether the escape was continuous or intermittent. While it is probably true that, under normal conditions, the presence of urine in the ureter is necessary to excite peristaltic contractions, it would seem to be equally true from our single observation, that the presence of a foreign body is sufficient to excite contractions similar in type to those seen under normal conditions, even after the removal of the corresponding kidney. One is hardly justified in drawing conclusions from a single observation, but it would seem that under certain pathological conditions, at least, peristalsis does take place independent of any stimulus derived from the kidney, and that, therefore, the ability to contract lies in the ureter itself, whatever its cause may be. Incidentally

we find a hint as to the necessity for the removal or destruction of the mucous membrane of the ureter after the removal of the kidney where the ureter is badly infected. Such a ureter, if not properly dealt with, may continue to harbor infection and furnish a focus from which the other kidney may become infected.

Reports of operations upon a single kidney, in the absence of the other, as a result either of a congenital defect or of disease, are scattered through the literature. The number of such cases, however, is not large, and in the greater number the operation was undertaken for calculous disease. The risk of surgical interference, which is always great because of the absence of the second kidney, depends further upon the nature and extent of the disease for which the operation is to be done. Where only slight damage to the secreting substance has occurred, and the patient is otherwise in good condition, there is no reason why operation should not be undertaken for the relief of distressing symptoms, especially where other means have failed. This is particularly true of calculous disease, where simple nephrotomy can be rapidly performed. It is to be borne in mind, however, that nephrotomy for calculus, even in the simplest case, may be followed by secondary hemorrhage, blood escaping either externally through the wound or internally into the bladder. The cause of hemorrhage in these cases we do not understand. The possibility of such a complication makes one hesitate in advising operation under such circumstances.

In most cases, however, surgical interference becomes imperative, either to relieve conditions which have become unbearable, or to save the patient's life, and no choice is left. The results obtained under these circumstances, even where the kidney is extensively diseased, are astonishing. It is surprising what a small amount of kidney substance suffices to do the work usually performed by two organs, and illustrates in a striking way the enormous reserve functional capacity of the kidneys. In our case, much of the secreting substance had

been destroyed and the remaining shell of parenchyma subjected to great pressure and distention, but as soon as the pressure was relieved, the remaining tissue quickly responded and excreted more than a hundred ounces during the first twenty-four hours, and nearly 150 ounces during the next day.

A case reported by Rosenstein is interesting in this connection. A young woman had had the right kidney removed for calculous disease. One and a half years later she complained of pain in the left kidney, and severe headache. The urine was cloudy with pus, and examination revealed a stone in the remaining kidney. Operation was postponed for two years, hoping it might be avoided. Finally the patient demanded an operation for relief of her intolerable suffering. The kidney was scarcely as large as a normal organ, the parenchyma was so thinned that the stones were not only felt but actually seen through the thinned kidney substance. Thirty-two stones were removed by opening widely all the calices. The patient, though desperately ill for a few days, made an excellent recovery. To add further interest to the case the stones were found to be pure cystin.

The only report I have noted in the literature of the last few years dealing particularly with operations upon a single kidney is that of Nicolich, of Trieste, who reports four very interesting personal cases.

THE CONTROL OF URINARY DRAINAGE AFTER CYSTOTOMY.

BY H. H. SINCLAIR, M.D., C.M.,

OF WALKERTON, ONT.

DURING the past six years there has been a steady endeavor on my part to decrease the discomforts following prostatectomy.

After the waste of much time and energy in contriving complicated apparatus, the following simple method has been found to meet all requirements:

Dental rubber dam is gummed to the skin by means of a cement made of dental crown rubber dissolved in xylol. This makes a strong non-irritant material which sets rapidly.

When the cement is fast, the rubber dam is folded to form a flat tube, which will convey the discharges to any convenient receptacle. The most convenient receptacle I have found for this purpose in prostate cases consists of a rubber glove stretched over an ordinary hard rubber pessary which has been molded to the surface to be drained. This is held in place by means of a sling of rubber tubing attached to a belt. Into the mouth of the glove the folded rubber dam is inserted. This is light and cleanly, and permits free movement. When one glove is in use the mate can be kept in an antiseptic solution to be ready when a change is required. Practice soon makes one expert with the method, and as this is acquired its range of usefulness extends greatly.

The formula is as follows: Take a sheet of crown dental rubber, cut in small pieces, drop these into a bottle, and cover with xylol. (I use a broad-mouthed glass-stoppered bottle, and if done in the evening the cement is ready for use in the morning.) Now cork the bottle and leave it alone.

When I wish to use it I decant the thin portion on top, and fill the barrel of an ordinary glass syringe (from the butt

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end) with the heavy thick portion at the bottom, as this will dry very quickly and is very strong. By inserting the piston one has a container which gives full control of the material. This can be expressed where and when it is required. The thicker the cement the quicker it dries. The method of use is as follows:

Temporarily pack the mouth of the drainage wound with gauze (to keep dry). Wash skin external to the wound with pure xylol, dry with gauze, run a broad ring of cement entirely around the wound well external to it.

Now take a strip of rubber dam and stretch firmly over the surface covered by cement and necessarily the wound. Keep fairly stretched or the contraction of the cement will cause the rubber dam to wrinkle and bulge away from the skin. When firmly adherent (two to five minutes), trim out the portion in the centre with a scissors curved on the flat. A heavy roller such as used for mounting photos is found very useful for getting a smooth, even surface.

The drainage can now be thoroughly controlled; by simply folding the edges of the sheet, discharges are directed to any desired spot.

I have used pure para rubber (washed, dried, and ground); it answers the purpose but the crown rubber is more generally obtainable and is stronger. Every dentist has crown rubber and rubber dam, whilst we all have xylol in our microscopic supplies. I may say that I have used more pessaries during the past year than for a long time previous.

This method has eased my patients and made a great saving in the amount of gauze, cotton, and laundry required for them. If it stands the test of time, it must effect a tremendous saving in these items in the larger hospitals. As a test a square of rubber dam 5 in. by 5 in. (cemented to the skin of the abdomen), has been worn for three weeks without the slightest inconvenience or discomfort. When it is desired the dam can be removed, the cement washed off with xylol, and a new piece applied as before.

This method has been found useful in mastoid, biliary, and

FIG. 1.
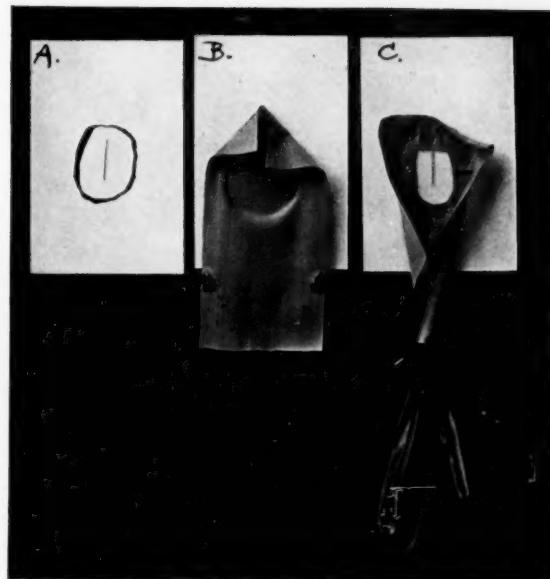
Rubber dam as used for urinary drainage after cystotomy.

FIG. 2.
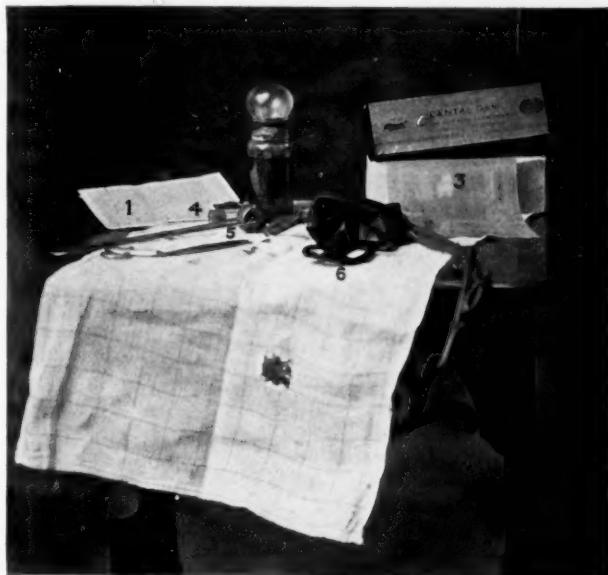
Materials assembled for making urinary rubber conduit. 1, crown rubber; 2, cement container; 3, rubber dam; 4, syringe; 5, roller; 6, pessary.
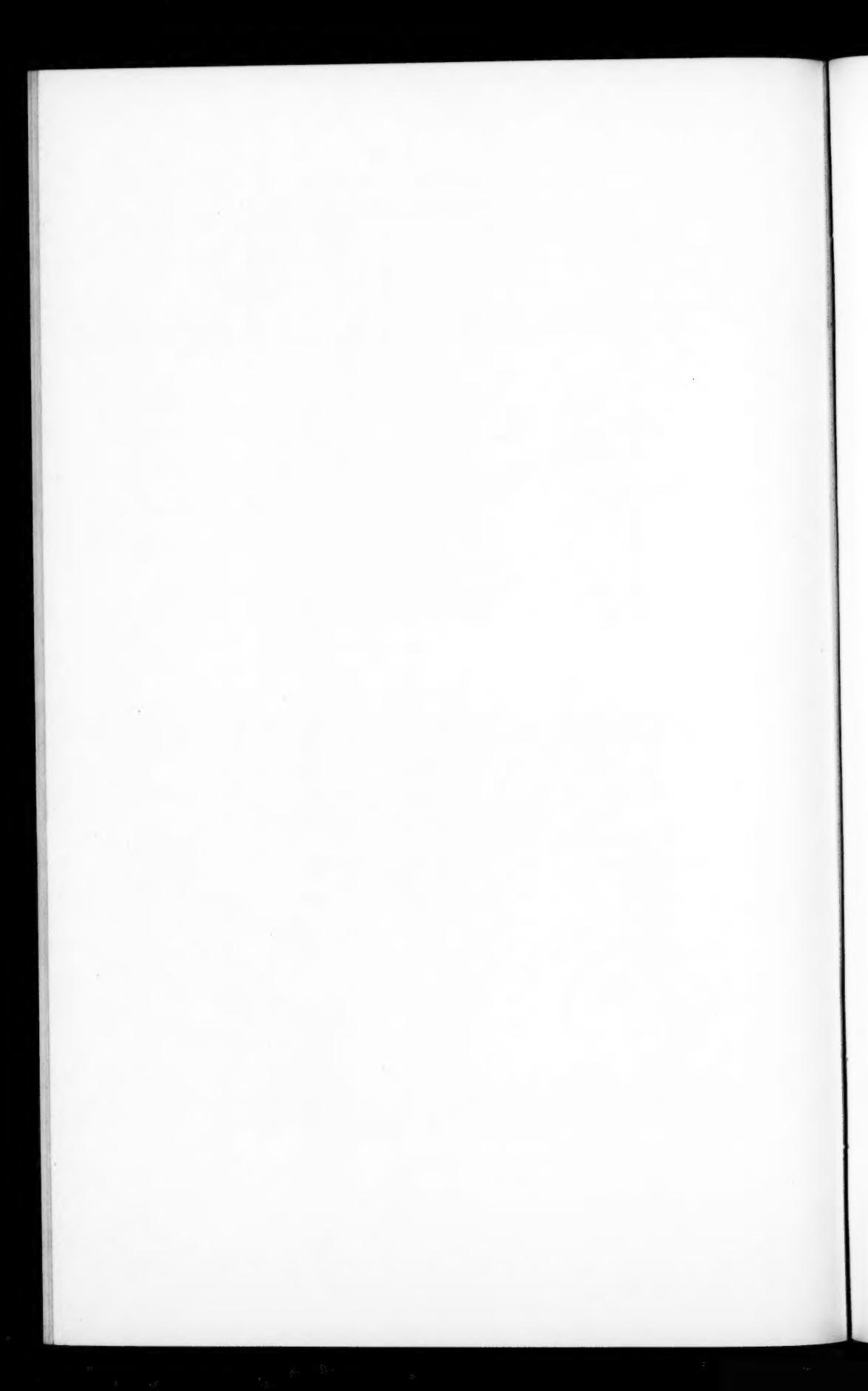
other cases requiring drainage.[1] It will be found especially useful in compound fractures, which have been put up in plaster, as the rubber dam prevents discharges running between the plaster and the skin inside the cast. Whenever the drainage area permits I roll the dam on a heavy glass roller and run it firmly over the surface. This is the best method where possible.

Gauze is placed between the rubber dam and the skin external to the line of cement to prevent sweating.

NOTE.—By the courtesy of Messrs. Johnson and Johnson I was recently furnished with some of their zinc oxide rubber mass as used for making adhesive plaster, which I find when treated with xylol in the same manner as the crown rubber is even more satisfactory. A small quantity of this could be obtained by dissolving the facing of zinc oxide plaster in xylol.

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[1] The Treatment of Compound Fractures, E. H. Ochsner, B.S., M.D., Medicine, Detroit, June, 1906.

THE TECHNIC OF MEDIAN PERINEAL PROSTATECTOMY.*

BY SAMUEL ALEXANDER, M.D.,

OF NEW YORK,

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EVER since 1887, when the late Mr. McGill, of Leeds, demonstrated the possibility of enucleating the enlarged prostate from its fibrous sheath through a suprapubic cystotomy, the thought and ingenuity of many surgeons have been directed to perfect this procedure, either by modifications and improvements upon McGill's method, or by surgically approaching the prostate by incisions through the perineum.

At the present time there are three well-recognized operative procedures for the removal of the obstruction caused by the enlarged prostate. These are, first, by suprapubic cystotomy and intracapsular enucleation; second, by median perineal urethrectomy and intracapsular enucleation; third, by a perineal incision, which exposes the posterior surface of the prostate and transcapsular enucleation. Each of these methods has its advocates. All of these methods have been modified and improved from time to time.

The controversies concerning operations upon the prostate which have arisen during recent years have been marked often with an undue personal animus which is to be regretted. These controversies have usually been upon minor points of technic and upon questions of priority, and too often the essential question, namely, the anatomical and surgical basis of the operations, has been overlooked or ignored. All of these operations are frequently performed successfully, but it would be an error to claim that any one of them is a perfect operation which can be performed by every surgeon with uniform success. The last word upon the technic of

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prostatectomy certainly has not been spoken, nor will it be until there is a more wide-spread and a better practical knowledge of the various pathological and anatomical changes which occur as the result of prostatic enlargement. There are, however, certain anatomical facts which can be clearly demonstrated, and these form the basis of any operation which has for its object the enucleation of the portions of the enlarged prostate which cause obstruction to urination, whether the operation be performed through a suprapubic cystotomy or by either of the perineal procedures.

In the present paper I shall call attention to what I regard as the most important of these anatomical facts, and I shall endeavor to point out their practical significance to the surgeon who performs this operation.

I. WHAT PORTIONS OF THE PROSTATE CAUSE OBSTRUCTION TO URINATION.

It may be positively stated that the portions of the prostate which cause obstruction to urination by their enlargement, whether this obstruction be mechanical or physiological, are those portions which lie upon the sides of the urethra and anterior to the seminal ducts. These are (1) the lateral lobes, and (2) the middle isthmus or middle lobe (when this latter exists). The portion of the prostate which lies behind the urethra and posterior to the seminal ducts does not cause obstruction. This portion I shall call (although perhaps not properly) the posterior isthmus of the lateral lobes.

The Line of Cleavage.—These two portions of the prostate, namely, the lateral lobes and the posterior isthmus of the lateral lobes, are separated from each other by a distinct line of cleavage. This line of cleavage is formed by a series of fibrous bands which radiate outward from a central nucleus, behind the urethra, and these bands pass outward and forward to join the sheath of the prostate. The shape and direction of this line of cleavage give to the posterior isthmus of the lateral lobes a more or less crescentic shape, with the

concavity directed forward. This posterior isthmus of the lateral lobes must become enlarged, but it never causes obstruction to urination. It is not necessary to remove it by prostatectomy, and it cannot be enucleated from the prostatic sheath. It is therefore an error, and not in accord with the facts of anatomy, to say that the entire prostate is removed by any of these prostatectomy operations,

The lateral lobes of the prostate which lie on either side of the urethra, and which, by their enlargement, cause obstruction to urination, are anterior to this line of cleavage. These lobes can be easily enucleated from the sheath of the prostate if the line of cleavage be followed. These lateral lobes in the prostate are loosely attached to the sheath of the prostate. The line of cleavage has a constant anatomical position; the relation of the line of cleavage to the urethra is always the same. This can be shown by a transverse section made through the enlarged prostate at right angles to the urethra. The line of cleavage always begins *posteriorly*, on the level with the floor of the urethra, and extends outward and forward so as to partially surround each of the lateral lobes. If, therefore, the urethral mucous membrane be torn through by the finger at the level of the floor of the prostatic urethra, the line of cleavage will be opened and the lateral lobes can be easily separated from the sheath of the prostate.

II. THE RELATION OF THE BASE OF THE PROSTATE TO THE BLADDER.

Normally, the muscular fibres of the bladder are attached to the upper part or base of the lateral lobes of the prostate. The base of these lobes is not enveloped by the fibrous sheath of the prostate. It is covered by the mucous coat of the bladder. This coat is rather loosely attached and may be easily pushed off from the base of the prostate by digital dissection.

The Anatomical Middle Lobe.—The lateral lobes of the

prostate are joined together by a wedge-shaped band of prostatic tissue, which varies in quantity in different individuals, and which runs behind the urethra and in front of the seminal ducts. This is known as the anatomical middle isthmus or middle lobe. When this band becomes enlarged, it arrests the finger during the enucleation of the lateral lobes from within the sheath. This middle isthmus, however, can be broken through at its junction with either lateral lobe by the finger. When the prostate is separated from its sheath by following the line of cleavage and the middle isthmus is broken at its junction with either lateral lobe, the latter is suspended within the sheath of the prostate only by the attachment of the mucous membrane of the urethra. This mucous membrane is easily torn through by the finger, and the enucleated lateral lobe then lies free within the prostatic sheath and may be extracted through the external wound by forceps. The enucleation of the lateral lobes is comparatively easy if the facts just mentioned are known and their practical value appreciated.

The enucleation of the middle lobe or middle isthmus, when this is enlarged and causes obstruction, is a little more difficult. The presence of a so-called middle lobe is not a constant factor in prostatic enlargement, and when there is present a so-called middle lobe enlargement, the condition is not always the same either morphologically or anatomically. I think it necessary, therefore, to call attention to certain anatomical facts, the importance of which does not seem to be appreciated by some writers upon this subject.

Some years ago I called attention to the fact that the so-called middle lobe enlargement which projects in some cases intravesically between the two lateral lobes is not always anatomically the same; it may be due either, first, to enlargement of accessory glands, which are situated in some cases just beneath the mucous membrane on the posterior side of the internal urethral orifice; or second, it may be due to enlargement of these glands, plus an enlargement of the anatomical median isthmus; or third, it may be due to

enlargement of the anatomical median isthmus alone. The importance of the enlargement of these accessory glands in this situation is that they push upward the muscular fibres beneath the trigone and thus interfere with the opening of the urethra at the time of urination. The real anatomical isthmus, when this is enlarged alone, can be removed or enucleated with the lateral lobe, which is last removed, by passing the finger beneath it and by stripping it off from its connection with the mucous membrane of the bladder. The enlargement of the accessory glands alone cannot be enucleated without tearing the mucous membrane on the posterior lip of the vesical outlet.

Since 1895, in nearly all cases, I have been doing a median perineal operation, which I shall now describe.

Preparation of the Patient for Operation.—As a rule, no special preparation is necessary. I think it is inadvisable to change in any important particular the habits of an old man, and therefore, unless there is some evidence of kidney insufficiency, I operate without any previous preparation, except that it is customary to give the day before operation a dose of castor-oil, and to follow this with a simple enema. It is best when possible to operate early in the morning, so as to insure for the patient a good night following the day of operation. The operative field of the perineum is prepared by shaving the surface and by washing with green soap and water. No antiseptic is used. The perineum is then covered with dry gauze and a towel. In anæsthetizing, nitrous oxide gas, followed by ether, is employed. The patient is put in a position of lateral lithotomy, the buttocks overhanging the edge of the table. It is not desirable to make this position extreme by over-flexion of the thighs upon the abdomen. The operating table should be high, so that the perineum will be on a level with the chin of the operator as he sits at the foot of the table. A lithotomy staff with a deep median groove is passed into the bladder. This is then given to an assistant who stands on the patient's left and who holds the staff steadily on the median line. The perineum is divided in the middle line by

an incision of about two inches in length, which terminates behind at a point about three-quarters of an inch in front of the anterior margin of the anus. The skin, the superficial fascia, and Colles's fascia are divided. Buck's fascia covering the accelerator urinæ muscle is not divided. The membranous urethra is divided by thrusting a sharp-pointed straight bistoury into the groove of the staff just behind the bulb of the urethra, and cutting forward the floor of the urethra and the lower border of the triangular ligament; a grooved director is then passed in until its point enters the groove of the staff. It is then gently pushed forward through the prostatic urethra and into the bladder, and the staff is withdrawn. The groove of the director is turned backward, and along this the bistoury is guided with the cutting edge directed backward, and the membranous urethra thoroughly divided up to the apex of the prostate. It is of the utmost importance that this division of the floor of the membranous urethra should be thoroughly done, and for this purpose a very sharp knife should be used so as not to lacerate the compressor urethræ muscle. The operator, holding the director in his left hand, introduces the forefinger of his right hand into the wound, and, keeping close to the groove of the director, pushes the finger forward until its tip has passed into the prostatic urethra. The director is then withdrawn, and the finger is advanced with a slight rotary motion through the prostatic urethra, thus dilating this portion of the canal. There is usually very little bleeding up to this point. In cases in which the prostate is not greatly enlarged, the finger can be passed through the prostatic urethra so that its tip will enter the bladder. In cases of marked lateral enlargement, it is sometimes impossible to force the finger entirely through the prostatic urethra.

The second step in the operation, namely, enucleation of the lateral lobes, is now begun. In order to proceed in a systematic manner, I always remove the obstruction from the side which is the larger, but when the two lateral lobes are of about equal size, I remove the right side first. The fore-

finger of the right hand is turned with the nail towards the floor of the urethra. The mucous membrane on the side of the urethra is torn through with the tip of the finger at a level with the urethra floor, and the line of cleavage is entered. As soon as the mucous membrane is torn, the finger, following the line of cleavage between the enlarged lateral lobe and the portion of the prostate lying behind it and the sheath, separates the one from the other by a sweeping movement outwards and forward. At the same time the tip of the finger is pushed upward toward the bladder wall. The pulp of the finger should be turned towards the prostatic capsule, and the nail should be kept closely to the outer side of the lateral lobe which is being enucleated. The finger should not pass beyond the middle line either in front of or behind the urethra, for it is perfectly easy to separate one lateral lobe from the other. When the side and posterior surface of one lobe have been freed from within the sheath, the base of the lobe which is attached to the bladder wall can be separated from the latter by hooking the finger above its upper margin, and by a sawing motion this can be easily peeled from the bladder wall without injury to the mucous membrane of the latter. When this has been done, the junction of the lateral lobe with the middle isthmus is torn through by the finger. The mucous membrane along the upper surface of the lobe is now torn through, and the enucleated mass can be picked out from within the capsule by a small pair of lithotomy forceps. These should be tightly closed in delivering the enucleated mass, so as not to unduly stretch the opening which has been made in the floor of the membranous urethra.

The same procedure is now followed on the opposite side, and in a case in which there is only lateral lobe enlargement, this completes the enucleation. In cases in which there is very marked enlargement of the lateral lobes, so that the tip of the finger cannot be passed through the prostatic urethra and into the vesical orifice, the enucleation may be begun in the manner above described, and the lateral lobe separated from

the prostatic sheath; but it may be necessary, in order to separate the lobe from its attachment to the bladder, to seize the lobe with forceps and draw it towards the perineum and over towards the opposite side. The forceps are held with one hand, and a gentle traction is made; the forefinger of the other hand is passed between the mass to be removed and the capsule of the prostate, and is hooked over the upper margin of the lateral lobe, which is then to be stripped off from the mucous membrane of the bladder.

When the lateral lobes have been removed and the line of cleavage closely followed, little injury will have been done to the prostatic plexus of veins which run through the sheath of the prostate, and therefore the bleeding will be inconsiderable. After the right lobe has been removed, it will be found that in separating the left lobe the working space within the capsule is increased and the enucleation of the second lobe is much easier. In cases in which there is obstruction on the floor of the urethra at the vesical orifice (so-called middle lobe enlargement), this is to be removed after the lateral lobes have been enucleated. In most cases the middle lobe can be enucleated with one of the lateral lobes, preferably that which is taken out last. This is done by simply separating it with the finger from beneath the lower lip of the urethral orifice. When this cannot be done, the middle lobe can be seized just beneath the mucous membrane of the bladder by forceps passed along the finger and separated from it.

The middle lobe, when enlarged, is sometimes quite difficult to remove because of its firm attachment to the bladder. If, however, the forefinger of the right hand be passed up into the space which was occupied by the left lobe, there is not much difficulty in pushing the middle lobe over to the right side and separating it from the bladder and the urethral mucous membrane. To facilitate this it may be caught with forceps and pulled down toward the perineum. In some cases the middle lobe consists simply of a soft tab of raised mucous membrane with the enlarged accessory glands. These cannot

be enucleated without tearing the mucous membrane, and in such a case I usually catch the tab with forceps, draw it down towards the perineum and cut it off cleanly with scissors in the same way in which the uvula is shortened. I have done this a number of times; the part cut off consists only of dilated glands and mucous membrane, and the cutting does not destroy the muscular fibres of the bladder.

At the completion of the operation of enucleation, the vesical outlet is felt as a soft ring which fits loosely the end of the forefinger. The floor of the bladder is level with the urethra. The mucous membrane about the vesical orifice is intact on all sides, and in case of enlargement limited to the lateral lobes, the mucous membrane upon the floor of the urethra, including the verumontanum, may be and usually is preserved. The cavities from which the lateral lobes have been removed are quite smooth. The position and shape of the prostatic urethra are preserved in a very remarkable degree by the contraction of the prostatic sheath and by the action of the levator ani muscles.

Changes in method are required in certain cases. When the prostatic lateral tumors are very large and consist of irregularly shaped masses each of which seems to be surrounded by its own capsule, it may be advisable to remove the lateral tumors from each side in two or three parts and not *en masse,* so as not to over-stretch the urethra or lacerate the compressor urethræ muscle. The line of cleavage between the tumors can be felt and they can be separated from each other and from the mucous membrane or bladder wall, and removed separately.

When it is necessary to do this some part of the lateral lobe may be overlooked and not removed. This is especially likely to occur about the vesical orifice. It should therefore be a rule that the operation is not considered complete until the mucous surface of the latter is felt to be smooth and even, the tissues pliable, and the orifice dilatable and its floor level with that of the bladder.

In cases of long-standing prostatic disease in which the

fibrous changes are marked in both the prostate and bladder wall, the enucleation of the obstructive masses is more difficult because of the firm attachment of these to the capsule and bladder wall by strong bands of fibrous tissue, which are difficult to break with the finger, and it is sometimes necessary to catch the obstructing mass with forceps and to divide the bands with scissors passed into the wound under the guidance of the finger.

The Control of Hemorrhage.—The operation of enucleation of the obstructing portions of the prostate being completed, the control of hemorrhage demands attention. I have found that when the neck of the bladder is drawn down toward the perineum after removal of the obstruction, the veins of the prostatic plexus are compressed and the hemorrhage ceases immediately. I therefore have adopted the following method to accomplish this: The tip of the forefinger of the left hand is introduced through the wound into the bladder, and is hooked over the lower lip of the vesical orifice. Along this finger is passed a pair of flat volsellum forceps, and with these the lower lip of the vesical orifice is grasped; the forefinger is withdrawn and slight traction made upon the forceps. The hemorrhage at once stops.

Bladder Drainage.—A metal tube is then introduced into the bladder and the bladder irrigated with hot water to remove all clots. The metal tube is removed and a large rubber catheter, No. 32 F, is passed into the bladder in front of the forceps. This should be accurately placed so that the eye of the catheter is just within the urethral orifice. Adequate drainage of the bladder depends upon the proper adjustment of this tube.

Wound Dressing.—An assistant holds this tube in place, while the surgeon packs with gauze the cavities left by enucleation of the lateral lobes. This packing should be made of iodoform gauze one inch wide. This is passed by long forceps alongside of the tube, and during its introduction gentle traction is made upon the forceps which hold the vesical outlet.

The ends of the gauze packing hang out of the wound. After the packing is in place the drainage tube is tested, and is then secured by pinning it to the skin with a safety pin. The dressing is then applied. This consists of a pad of gauze which is slipped between the skin and the safety pin,—two or three pads of folded gauze on either side of the tube and two pads of cotton and gauze. These are to be held in place by a special 3-tailed T bandage. During the dressing the surgeon makes gentle traction upon the forceps to prevent the bladder from slipping upwards and causing bleeding. The tube is then tested again and the patient put to bed. The forceps holding the bladder are then removed, and a simple siphon tube is attached to the bladder tube by a glass connection. The siphonage tube should be passed under the patient's knee and the free end dropped into a large bottle placed at the bedside, containing six or eight ounces of a 1 : 5000 bichloride solution. The siphon is secured by a pin to the draw sheet of the edge of the bed. When siphonage has been established the glass tube will be full of fluid, but if the drainage stops the tube will be empty. The tube may be full and yet drainage may be defective if a clot of blood plugs up the eye; when this occurs there will be leakage along the tube and soiling of the perineal dressing, and there will be associated with this pain at the end of the penis and a painful desire to pass water. The efficiency of the drainage and the comfort of the patient after operation depend upon the care with which the drainage tube is placed and secured. If the siphonage tube is too long it causes pain by sucking the bladder wall into the eye of the tube. When the drainage tube is properly adjusted and secured and the dressing evenly and artfully applied, the patient has no pain and rarely needs an anodyne. With this mode of dressing and drainage the patient may lie upon his back or upon his side (the side opposite to that on which the siphonage bottle and tube are placed), but the position of these may be changed from time to time to suit the wishes of the patient and to permit of his freer movements.

   The Post-operative Management.—The management of

cases after prostatectomy is of as much importance to secure a successful result as the operation. A skilfully performed operation may fail by unskilful nursing or failure to attend to the necessary details, but I now expect to have prostatectomy operations follow much the same course as simple perineal sections.

General Treatment.—For the first two or three days I give a light diet of eggs, cereals, milk, broth, tea, toast, and as much water as the patient can be made to take. If the drainage is perfect there will be little leakage about the tube, but if the prostate removed has been large there may be some leakage along its sides by the capillary action of the gauze strips, which will necessitate the changing of the outside dressing. If there is no pain and no clogging of the tube by retained clots the tube should be gently washed out once or twice to keep it clear and to remove pus in cases of cystitis. In some cases a pillow placed under the patient's knees will give relief to the backache due to the dorsal position. If the drainage is perfect and the patient comfortable, this is the plan to follow for 24 hours. A cathartic is given at the end of 24 hours. I then make the first change of dressing. The tube is removed and the gauze packing is taken out of the wound and the urethra flushed out with saline solution. After removing the gauze there is sometimes free oozing of blood, but this stops in a few minutes. A little iodoform gauze or gauze soaked in a 2 per cent. protargol solution is placed between the edges of the wound so as to separate them. I then apply over the perineum a cotton gauze dressing in the form of pads secured by the 3-tailed T bandage. These are changed every two to three hours.

After removing the tube there is usually almost complete urinary incontinence for two or three days. This is because the patient cannot control his over-stretched and atonic sphincter. But control is soon gained and he then passes voluntarily at first through the wound. The discharge of urine through the urethra usually begins about a week after operation. The dressing of the perineum should be changed

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as often as necessary to keep it dry, and the wound should be washed by a flow of water injected into it from a syringe to wash away any urine; the skin about the anus and wound should be powdered with talcum. The wound is subsequently inspected twice a day and is made to heal from the bottom. The edges of the wound should be wiped with cotton every day to prevent the growth of epithelium into it.

It is not my custom to pass any sound through the urethra for several weeks after operation. The bladder for the first three days is washed out by passing a catheter through the perineal wound. After this time, if it is necessary to wash out the bladder on account of a cystitis, a catheter a coudé can be easily passed through the urethra.

The Control of Urination and the Return of Vesical Power.—It is not to be expected that the patient's control over urination should be immediately and perfectly re-established, when we consider that the operation has disturbed the relation of the sphincters and caused them to become atonic by stretching, but it is surprising how quickly this control returns, although sometimes after the operation the calls to urinate, if not heeded, will be followed by involuntary escape of urine. But as soon as the wound has healed and the tissues which have been cut and disturbed have consolidated, the power of retaining and expelling urine voluntarily is perfect. In most cases now this can be expected in six or eight weeks, but in many this result is obtained much earlier.

The return of vesical function, no matter how atonic may have been the bladder, is to be confidently expected, provided there remain no obstruction to urination and there be no incurable cystitis. As a rule the bladder is free of cystitis by the time the perineal wound is healed. Its expulsive power gradually improves, and there is only to be noted that the capacity may be lessened, owing to the weakening of the muscle at the vesical outlet which permits a little urine to escape into the urethra before the former capacity of the bladder is exceeded. On this account we find that the intervals of urination after operation may be four instead of six

or eight hours, and the patient may have to get up once or twice even during the night. This condition improves with time, but should be understood. The cystitis in any case will get well under washing and local injection, if the bladder is not sacculated and if there is no obstruction to urination.

ADVANTAGES OF THIS OPERATION.

1. It is a clearly defined surgical procedure which has a rational anatomical basis.

2. It can be very rapidly performed by a practised hand, the operation lasting rarely more than five minutes and the patient being not more than 15 or 20 minutes upon the operating table.

3. The hemorrhage can be quickly and effectually stopped.

4. The drainage of the bladder is simple, and need not be maintained after the first 24 hours.

5. The patients are spared the discomforts of continuous drainage and irrigation.

6. The comfort of the patient is much greater than after any other form of prostatectomy.

7. The functional results are very satisfactory.

AN OPERATION FOR STIFFENING THE KNEE-JOINT.*

BY RUSSELL A. HIBBS, M.D.,

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THE operation of stiffening joints has been done very generally during the past few years in cases of infantile paralysis, especially in the joints of the foot and ankle when the permanent damage to muscle and ligamentous structure has been such as to make necessary the indefinite use of apparatus to prevent deformity and secure function.

The knee-joint, however, I do not believe has been stiffened frequently enough, especially among the classes of people we see in the dispensaries, who are, in most instances, wage earners, and the necessity of wearing some form of brace permanently is troublesome and expensive to them.

This is probably due to the fact that attempting to stiffen this joint by the old method of doing practically an excision has not been very successful. In the first place the removal of a sufficient amount of cartilage from the femur and tibia to secure bony surfaces for approximation shortens the leg about 1½ inches, which, with the shortening already present in these cases, is a serious consideration. And in the second place, the removal of the ligaments makes difficult the prevention of deformity during the long period, a year or more, before there is solid bony union.

This led me on January 15, 1909, to perform an operation which obviates these disadvantages. It was that of mortising the patella, after it was denuded of its periosteum and car-

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* Read before the Orthopædic Section of the New York Academy of Medicine, October 21, 1910.

tilage, into a space prepared for it by the removal of the cartilage, just anterior to the centre of the tibia and femur. It will be found that such a space may be secured without injury to the crucial ligaments or to the epiphysis of either bone. With the patella in this position, a perfect bony bridge is thus formed between the tibia and the femur.

There was some question in my mind as to the nutrition of this bone in its new position, so that in the first few cases the upper attachment of the patella ligament and periosteum was left intact, in order to leave undisturbed the subperiosteal vessels. Later this precaution was considered unnecessary and was discontinued. The patella in the first three cases was put in transversely, and in the next four, horizontally. In all these cases, in from five to six months there was solid bony ankylosis, which has been maintained a sufficient length of time since the removal of support to consider it permanent.

(The first case, with a description of the operation, was reported to the Boston Orthopædic Club, March 24, 1909.)

It then occurred to me that if the patella was placed horizontally in a space prepared for it, and then if the periosteum was carefully preserved in its removal from the patella and brought down over the freshened area and stitched to the periosteum around the edges of the tibia and femur, there would be reproduced from this periosteum new bone, so that our bony bridge would be larger and stronger.

In the last three cases this procedure has been adopted, as shown in Figs. 1, 2, and 3, and in each case there has been a reproduction of bone from this periosteum, as has been unmistakably shown by X-ray pictures. The advantages of this latter procedure are obvious. In the first place there is less likelihood of the patella slipping out of its bed, and in the second place there is secured, through the reproduction of new bone, a larger and stronger bony bridge, and the weight may be safely borne on the leg earlier with advantage, and all support removed sooner.

These cases have walked in plaster at the end of from four to six weeks, and all support has been removed at the end

of the fifth to the seventh month. Except in the three last cases, all support was removed at the end of the fourth month.

It is important to note what an adequate bony bridge the patella makes, and, in addition, how far beyond the edges of the patella (Fig. 3) the periosteum extends when stitched to the periosteum of the femur and tibia, which measures the extent of the new bone produced. This operation would seem to be an ideal one in such cases as are here reported, and in addition it would seem helpful in excision cases for disease of the knee-joint when the patella is healthy, to utilize it and its periosteum in this way as a bridge between the two bones.

The operation in all these cases has been done through a transverse incision just below the patella. The periosteal and skin sutures were of ten-day chromic catgut. The wound was closed without drainage and a plaster spica applied. The wound was dressed through a window on the tenth day, and in every case found to be completely healed. The ages of these patients have been from thirteen to seventeen years. I believe, however, that younger children could be operated on with equally good results.

CASE I.—Ethel H., age thirteen years. Infantile paralysis. Loss of control of right knee.

Operation.—January 15, 1909, patella mortised into the joint transversely. Ligaments unimpaired. Wound closed without drainage. Plaster spica applied. Walked in plaster after ten weeks, and in six months all support removed. Result, complete bony ankylosis.

CASE II.—Mary H., age fifteen years. Infantile paralysis. Loss of control of right knee.

Operation.—March 1, 1909; walked in plaster April 19, 1909. Walked without support in 5½ months. Result, complete bony ankylosis.

CASE III.—Kenneth W., age fourteen years. Infantile paralysis. Loss of control of left knee.

*Operation.*—April 30, 1909; walked in plaster June 30, 1909. In seven months walked without support. Result, complete bony ankylosis.

Fig. 1.

Crucial ligaments
unimpaired
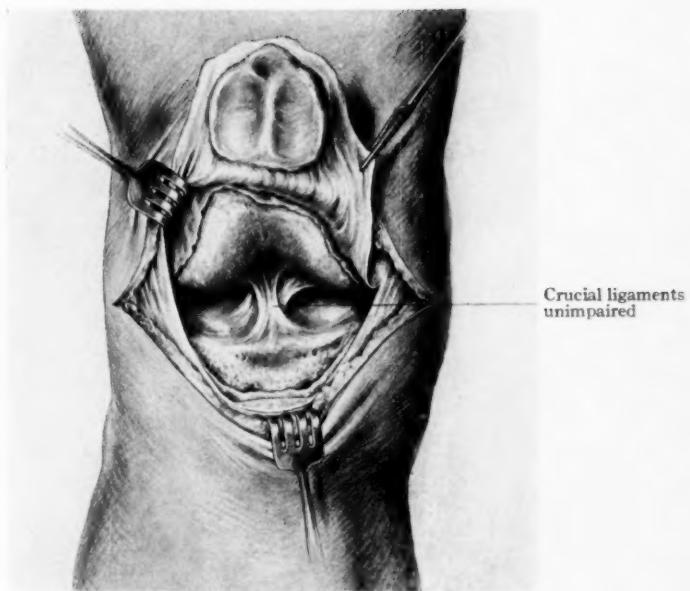
Shows space on the femur and the tibia prepared to receive the
patella.

FIG. 2.

Femoral periosteum

Tibial periosteum

Patella in place.

FIG. 3.

Line of suture of
patella periosteum
to femoral perios-
eum

Line of suture of
patella periosteum to
tibial periosteum
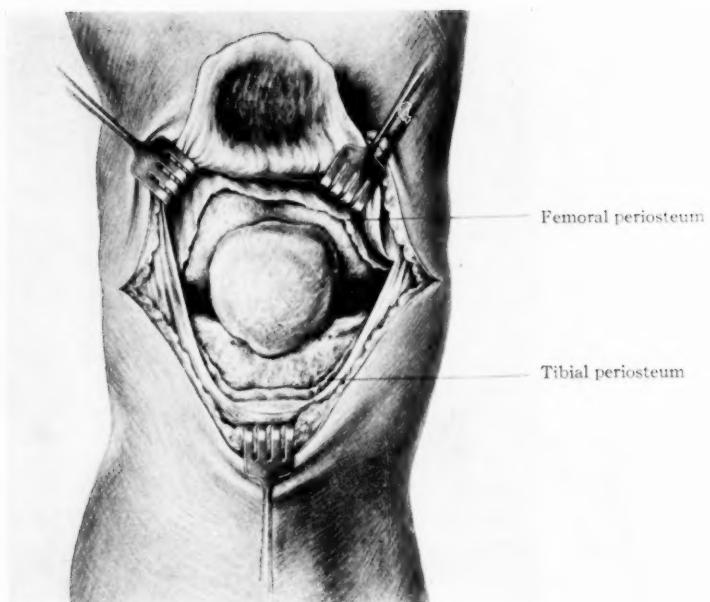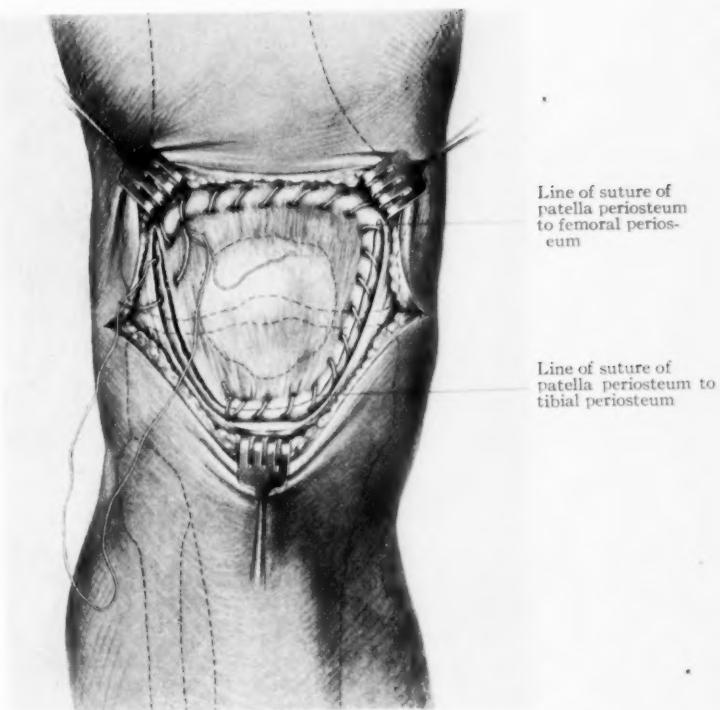
Periosteum of the patella stitched to that of the femur and tibia.
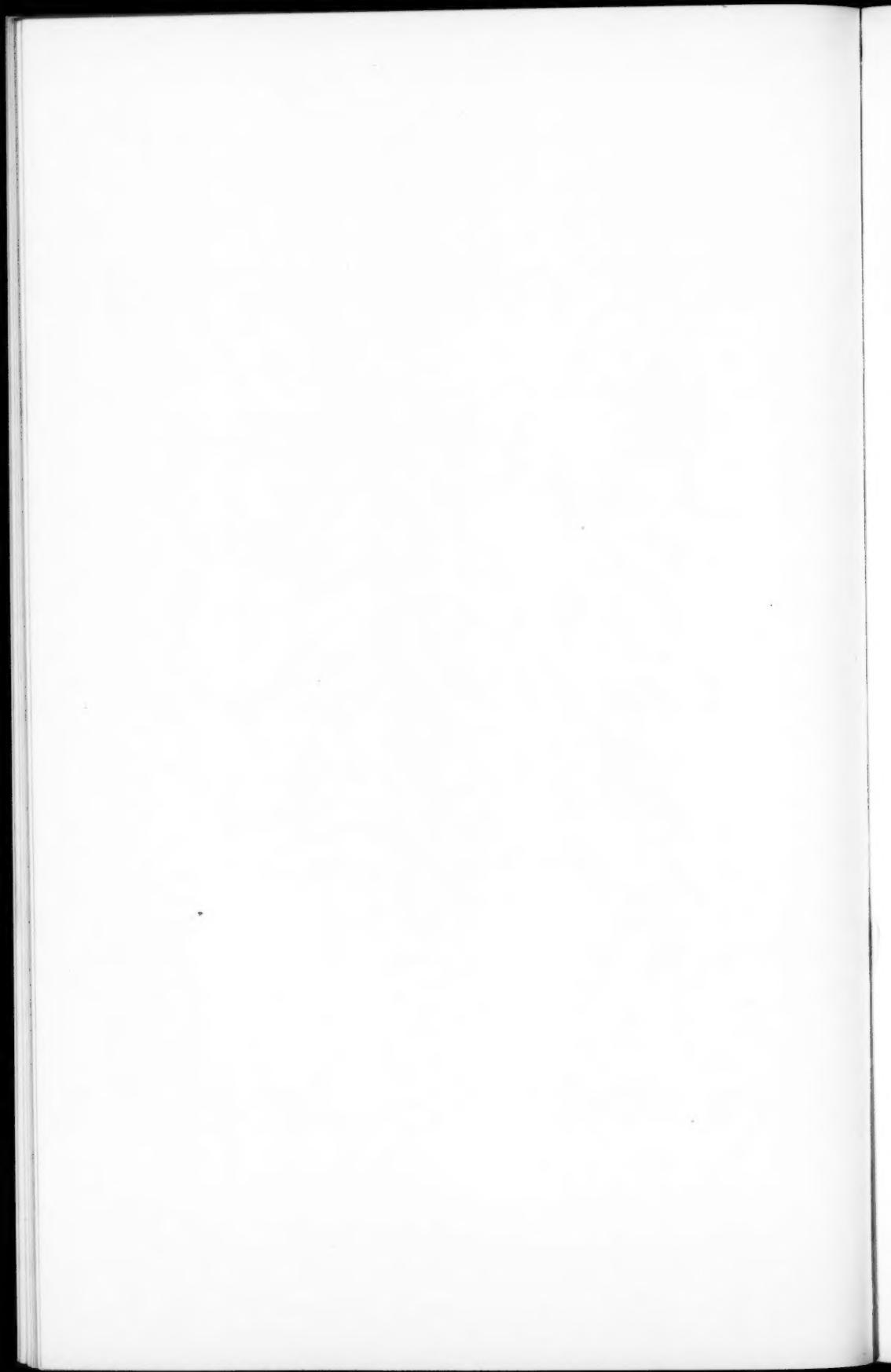
CASE IV.—Annie H., age sixteen years. Infantile paralysis. Loss of control of right knee.

Operation.—September 15, 1909. Result, patella slipped from its bed and became adherent to the femur. The second operation was on October 18, 1910, the patella being replaced horizontally. January 10, 1911, the ankylosis is firm, though short plaster still worn.

CASE V.—Sarah W., age seventeen years. Infantile paralysis. Loss of control of right knee.

Operation.—September 30, 1909; walked in plaster October 13, 1909. All support removed in six months. Result, firm bony ankylosis, patella put in the joint horizontally.

CASE VI.—Mary S., age thirteen years. Infantile paralysis. Loss of control of left knee.

Operation.—October 11, 1909; walked in plaster November 3, 1909. All support removed after five months. Result, complete bony ankylosis.

CASE VII.—Isaac S., age fifteen years. Infantile paralysis. Loss of control of left knee.

Operation.—November 1, 1909. All support removed in five months. Result, complete bony ankylosis.

CASE VIII.—Concetta S., age sixteen years. Infantile paralysis. Loss of control of knee.

Operation.—November 26, 1909; periosteum of the patella preserved and stitched, as shown in the illustrations. In four months all support was removed. Result, complete bony ankylosis.

CASE IX.—Emma T., age fourteen years. Infantile paralysis. Loss of control of right knee.

Operation.—July 12, 1910; operation, as in Case VIII. Walked in plaster September 27, 1910. In four months all support was removed. Result, complete bony ankylosis.

CASE X.—Rachael G., age twelve years. Infantile paralysis. Loss of control of right knee.

Operation.—July 22, 1910, as in Case VIII. Walked in plaster September 27, 1910. All support removed in four months. Result, complete bony ankylosis.

INTUSSUSCEPTION IN THE ADULT.*

TWO CASES, ONE DUE TO MULTIPLE ADENOMATA OF THE INTESTINE, THE OTHER
TO A SARCOMA OF THE CÆCUM : WITH A DISCUSSION OF
ADENOMATA OF THE INTESTINE.

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INTUSSUSCEPTION is the most frequent variety of ileus, and, according to Leichtenstern, forms 30 per cent. of all cases of ileus. Although it is far more frequent in children, it is not altogether rare in adults.

As regards etiology, we must distinguish between the invaginations in small children and those in older children and adults. In the former the cause is usually to be sought in peculiarities of development and function of the intestine, which are generally not of a pathological nature, while in the adult, as a rule, we find some gross lesion of the intestine to be the underlying cause of the invagination. Of these lesions the most frequent and best known are tumors of the intestinal wall, and it is not often the malignant tumors that give rise to the intussusception though they may be at fault, but the benign tumors, cysts, adenoma, angioma, myoma, lipoma, and fibroma, especially when they are pedunculated. Among other causes of intussusception are ulcerations of the intestine, inverted appendices, and Meckel's diverticula.

In this connection it might be of interest to examine somewhat more closely into the etiology and mechanism of intussusception, as some further light has been shed upon the subject in recent years by the publications of Lorenz, and Delore and Leriche.

According to Nothnagel, invagination is due to an ab-

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* Read before the Southern Surgical and Gynæcological Association, December 15, 1910.

normally active tetanic contraction of a circumscribed portion
of the bowel, that part of the bowel below the constricted
portion being drawn up over it, apparently by the action of
the longitudinal muscle fibres, the intussusceptum growing at
the expense of the ensheathing bowel. In order that an in-
vagination may take place, it is necessary that one portion
of the bowel involved in the intussusception possess at least
a certain degree of mobility. This is always present in the
small intestine, but in order for the large intestine to become
invaginated, it is necessary for its embryological mobility to
have persisted abnormally or for it to have acquired a loose
mesocolon secondarily by traction.

Whereas various explanations, such as the disproportion
in size of the ileum and colon, the fixed condition of the colon
and the mobility of the ileum, a tenesmus-like spasm of the
ileocæcal valve, etc., have been advanced to explain the great
frequency of intussusceptions in the ileocæcal region, Lorenz.
and Delore and Leriche believe that the abnormal mobility
of the colon, mentioned above, is the chief cause of these in-
vaginations. The fact that perhaps 68 per cent. of cases of
intussusception occur in children under one year of age is
easily explained by this congenital hypothesis. It is only in
the latter part of intra-uterine life that the ileocæcal region
(the usual site of intussusception) begins to be fixed. This
fixation takes place slowly and at birth is not always com-
pleted; 48 per cent. of fetuses at term have a mobile cæcum
and consequently in the first days of life the cæcum can be
invaginated more or less extensively. Gradually, however,
the fixation advances and in 85 per cent. of adults the first
part of the large intestine is firmly fixed in the right iliac
fossa, while in 15 per cent. it enjoys a certain degree of
mobility, due either to a congenital abnormality or to a long
mesocolon which has resulted from traction. When we re-
member that in some cases of invagination the ileocæcal valve
may reach the rectum, we must realize the great mobility of
the cæcum and colon in these cases.

While the various forms of intussusception—ileocæcal,

enteric, colic, ileocolic and iliaco-ileocolic—are generally described as occurring in the order named, Lorenz, and Delore and Leriche find that in many cases of so-called ileocæcal invagination the apex of the intussusceptum is formed, not by the ileocæcal valve but by the head of the cæcum and the appendix, and are really cases of cecocolic intussusception. Lorenz thinks the appendix plastered to the head of the cæcum may act as a tumor and be of some moment in the production of such intussusceptions.

There is also some discussion as to the manner in which pedunculated tumors give rise to invagination. Some say the invagination is produced by the mere weight and pull of the tumor on the intestinal wall as it is carried forward by peristalsis and the stream of fecal material; others believe that the presence of the tumor excites a violent peristalsis, which results in the formation of an invagination, and state that if the former view were true the tumor would always occupy the apex of the intussusceptum and this is not always the case.

It has been my fortune to meet with two cases of intussusception which were due to tumors in the intestine. These I will describe in some detail:

CASE I.—*Intussusception due to multiple polypoid adenomata of the intestinal tract.*

S. P., aged twenty-four years, Russian, was admitted to the Johns Hopkins Hospital, August 7, 1906, complaining of abdominal pain.

Family History.—Unimportant. No history of similar trouble in his family.

Personal History.—When five years of age he had prolapsus of the rectum. With each defecation the bowel would prolapse for an inch or two, but was usually easily reduced. Occasionally there would be some bleeding. This condition lasted for some years and disappeared spontaneously.

Present Illness.—For the last three years the patient has noticed occasional cramp-like pains in the abdomen, which usually lasted only a few minutes. These pains were diffuse, not well

localized, and did not incapacitate him for work. Occasionally he would vomit. Six months before admission the cramps became more frequent, sometimes lasted from one-half to one hour, and were usually located in the region of the umbilicus. The pains apparently bore no relation to taking food or to defecation. He vomited every few days, though his bowels remained regular. He stated that he was unable to work for three months, then worked for a while in a desultory way. Four days before admission, soon after luncheon, the patient had a normal movement of the bowel, followed in a few minutes by a dull nauseating pain in the region of the navel, and he vomited once, vomitus consisting of food he had eaten shortly before. Bowels moved twice the next day. Consistency of stools normal. No further vomiting, but a continuous dull pain in the region of the navel for two days before admission. Patient was unable to sleep on account of the pain and nausea. On further questioning, he stated that three years ago he had a similar attack with intense pain, diarrhœa, and bloody stools, which lasted a month.

Examination.—Patient was a pale, rather poorly nourished man. Pulse 96 to the minute, temperature 100, leucocytes 15,600. Examination of lungs, heart, and urine negative. The abdomen was somewhat distended, and numerous loops of intestine could be seen traversing the abdomen in a ladder pattern. Definite peristalsis noted at times. In the right side of the abdomen there was a large sausage-shaped mass which extended from the right iliac fossa to beneath the costal margin. This mass was fairly soft but varied in consistency. Rectal examination negative.

First operation, Aug. 7, 1906: *Exploratory laparotomy; reduction of intussusception.*

An incision was made over the right rectus muscle opposite the umbilicus. The peritoneal cavity was found to contain a small amount of free fluid. The lower portion of the small intestine was greatly distended, being 10–12 cm. in diameter, and the walls of the intestine were somewhat hypertrophied. The obstruction was found to be due to an intussusception, 25 cm. long, in the ileocæcal region, apparently of the iliaco-ileocolic variety. It was reduced by milking the colon and making slight traction on the ileum. There were few if any adhesions and no gangrene. Examination of the ileum after reduction showed the presence of two tumors 3 and 6 cm. in diameter, one 25 cm.

above the ileocæcal valve, the other and smaller 20 cm. higher up in the intestine. They seemed to be pedunculated, rather spherical in shape, smooth, and fairly soft. The larger tumor was apparently the cause of the intussusception, as traction upon it had caused an umbilication over its attachment, which was near the mesentery. The third tumor, which was about 6 cm. in diameter, was palpated in the sigmoid colon. It was deemed inadvisable to remove any of the growths on account of the distended condition of the bowel. It was thought that this could be done to better advantage at a subsequent operation. The wound was closed without drainage.

Second operation, Aug. 14, 1906: *Laparotomy; reduction of intussusception; resection of* 17 *inches of ileum.*

Patient's symptoms were entirely relieved by the first operation until August 12, when his abdominal pains returned and on August 14 his condition was about as when he was admitted. The wound was reopened and practically the same condition of affairs found as at the former operation. The intussusception was perhaps somewhat longer than before, and was reduced with more difficulty owing to œdema of the intestine. About 17 inches of ileum containing the two tumors (Fig. 1), was excised. The bowel was united by a lateral anastomosis, and the abdominal wound closed after placing an iodoform gauze drain down to the ends of the intestine, which were brought beneath the lower end of the incision.

Third operation, Oct. 8, 1906: *Resection of colon and lateral anastomosis of the small intestine.*

Since the last operation the patient had done well except that a small intestinal fistula, which resulted, continued to discharge. It was thought that this might have been kept open by the obstruction produced by the tumor in the sigmoid. An incision was made through the lower portion of the left rectus muscle, and about four inches of the sigmoid containing the tumor was excised (Fig. 2), and the bowel united by a lateral anastomosis. The intestinal tract was then thoroughly examined for further tumors; none were found in the large intestine, but numerous soft pedunculated tumors were found in the small intestine. One of these, several feet above the former iliac anastomosis, seemed to be producing a slight invagination, so a lateral anastomosis was done, shunting it out. The abdomen

Fig. 1.

Section of small intestine showing tumors.

FIG. 2.
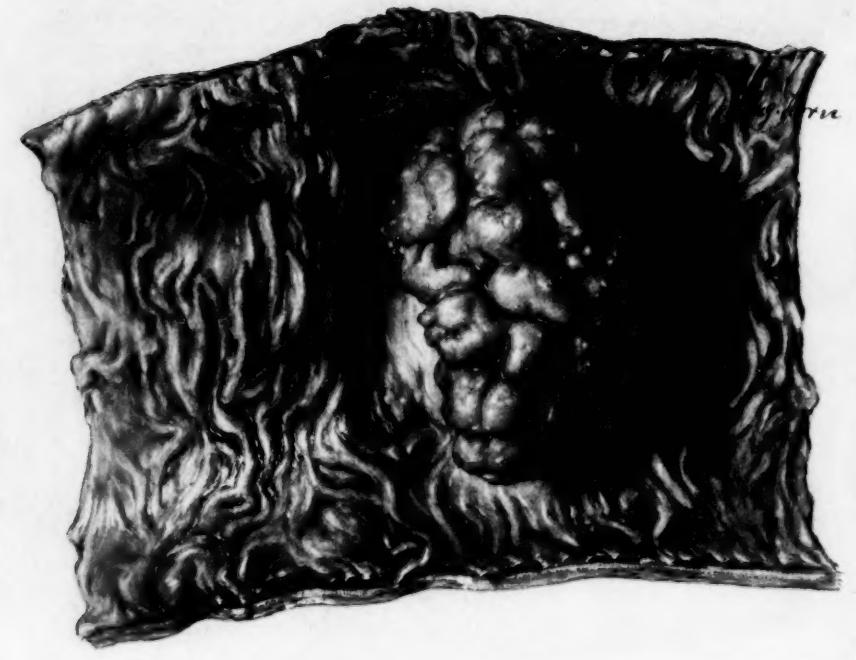
Section of large intestine with adenoma.

was then closed, a small drain being placed down to the large intestine suture.

Fourth operation, Jan. 3, 1907: Excision of multiple adenomata of the small intestine; lateral anastomosis of the small intestine; closure of intestinal fistula.

Since the last operation the patient had done nicely, but the intestinal fistula still discharged somewhat. An incision was made through the upper portion of the left rectus muscle. The jejunum was first examined and found to contain numerous soft masses, evidently intra-intestinal growths. One of these was situated just below the junction of the duodenum and jejunum. The growths were removed through small incisions in the intestine opposite to the mesentery, their pedicles being clamped and ligated with catgut. In this manner four tumors 2 to 3 cm. in diameter were removed from the jejunum. The small intestine was then examined systematically from the jejunum downward, and five other growths found and removed as above. One of these was somewhat sessile, and after excising its base and closing the opening in the intestine, the intestinal lumen was found to be so much narrowed that it was necessary to do a lateral anastomosis around the stricture. The abdominal wound was then closed, and the persistent intestinal fistula from the second operation dissected out and sutured.

The patient recovered rapidly after the operation, and was discharged from the hospital on March 8, 1907. To sum up, the following operations were performed upon him: an operative reduction of intussusception, two intestinal resections with lateral anastomoses, two other anastomoses, and seven enterotomies.

He was seen about a year after his discharge from the hospital and was in good health.

Pathology.—The tumors removed vary from 1 cm. to 6 cm. in diameter. They are generally of a reddish color, though several are yellow or grayish, and most of them are pedunculated, while a few are more or less sessile. In some the surface is smooth, but most have an irregular, somewhat papillomatous appearance. This is particularly true of the large tumor, causing the original invagination, which has a cauliflower-like structure. They seem to have little if any tendency to invade the intestinal wall. Microscopically they present the typical picture of adenomata, namely a hyperplasia of the glands of Lieberkühn upon a stroma of connective tissue, the glands being very similar to those of the normal mucosa, but are larger and show a greater tendency

to branch. At the edges of the larger tumor (Fig. 1) the glands seem to invade the submucosa and thus suggest carcinoma, but the character of the cells does not point to malignancy and there is apparently no invasion of the lymphatics.

CASE II.—*Intussusception due to a sarcoma of the caput cæci.*

Mr. R. K., aged nineteen years, student, was admitted to the University of Virginia Hospital on May 25, 1910, complaining of pain in the right side of the abdomen and discharge of blood from the bowel.

Family History.—Unimportant. No history of tuberculosis or new growths.

Personal History.—He has had mumps, whooping-cough, chicken-pox, and recovered without sequellæ. No other diseases. Has had no symptoms pointing to disease of the heart, lungs, or kidneys. Until present illness digestion has been good. Bowels have been regular, and there has been no vomiting of blood, no bloody diarrhœa, no hemorrhoids.

Present Illness.—Patient was taken sick while in Baltimore about three or four weeks before admission to the University of Virginia Hospital. For about a week patient had had fleeting pains in the lower right abdomen. These became more severe, and at the end of a week he went to bed and took a dose of castor-oil. The next day his bowels moved and he passed a good deal of dark blood. The pain in the abdomen became more severe and general, though it was always worse on the right side, and he was taken to a hospital. He was not nauseated, did not vomit, and had no temperature. Blood appeared in each bowel movement, and the pain was always most marked just before the bowels moved. Appendicitis was suspected, but the bloody stools caused this diagnosis to be abandoned. The patient remained in the hospital and gradually became better. The pain disappeared, the hemorrhage from the bowel ceased in ten days, and the patient came to his home in Virginia after fifteen days. Four days after coming home he had another attack. This time the pain was more intense and more sudden in onset, and patient again passed blood by the bowel. On the day before admission, he was nauseated, vomited, and, the pain continuing, he was brought to the hospital.

Examination.—Patient was a well-nourished young man, but quite anæmic and looked rather sick. Pulse good volume, fair

tension, 84 to the minute, temperature 99.5, leucocytes 11,000. The abdomen was somewhat distended, but no loops of bowel could be seen and there was no visible peristalsis. The whole abdomen was rather tense, and no mass could be felt even on deep palpation. There was slight general abdominal tenderness and marked tenderness in the lower right abdomen. An enema was given and brought away considerable dark bloody material. No definite diagnosis was made.

Operation, May 25, 1910: *Exploratory laparotomy; reduction of cæcocolic intussusception and excision of tumor of the caput cæci.*

An incision was made through the right rectus muscle opposite to the umbilicus. The small intestine was not much distended, but the large intestine was considerably so. A soft mass the size of a goose egg was felt in the upper abdomen, and proved to be a large blood-clot in the transverse colon. It was milked down into the rectum and a considerable amount of blood expressed from the anus. In the region of the cæcum a doughy mass, 13 cm. in length by 7 or 8 cm. in width, was felt, and on examination proved to be an intussusception of the cæcum. It was purely a colonic intussusception, as the ileocæcal junction and appendix were in no wise involved. The intussusception was reduced by milking the colon, and after the reduction a small mass about 6 cm. in transverse diameter by 2 cm. in thickness was felt in the head of the cæcum. It was apparently an intestinal polyp, which occupied the apex of the intussusceptum and was doubtless the cause of the intussusception. The intestine was opened at this point and the polyp, which had a pedicle about 2–3 cm. in diameter, was excised with an elliptical portion of the wall of the gut. The opening in the intestine was closed with a continuous linen suture and then the abdominal wound was closed, a small drain being placed down to the intestinal suture. The patient made a good recovery and left the hospital June 18, 1910. He was seen four months later and appeared to be in excellent health.

Pathology.—The tumor, which measures about 6 cm. in transverse diameter by 2.5 cm. in height, is attached to the intestinal wall by a pedicle about 3 cm. in diameter. It is of a dark red color, has a ragged, somewhat villous looking surface, and is covered by rather adherent blood-clots. It seems to show little tendency to invade the intestinal wall.

Microscopic Examination.—Section of large intestine. A small bit of normal mucosa is seen at either end of the section. In the rest of the section the mucosa is replaced by a new growth, which invades the submucosa and extends a short distance into the muscularis. The serosa is normal. The new growth is made up of small round cells, with moderately darkly staining, somewhat vesicular nuclei, surrounded by a moderate amount of non-granular, lightly staining protoplasm. Very few mitotic figures are seen. There is everywhere a minimum of stroma and many small and large, new-formed blood-vessels, the tumor cells being in contact with the single layer of endothelium forming the blood-vessel wall.

Diagnosis.—Small round-cell sarcoma, arising in the submucosa.

Inasmuch as adenomata are the most frequent tumors giving rise to intussusception, and since one of my cases was due to such tumors, it behooves us to study them more carefully. In the following remarks upon adenomata of the intestine the very excellent article of Smoler has been consulted freely.

Adenomata of the intestine are usually found by pathologists in persons who have died from other causes and in whom the tumors have produced no symptoms. They appear in all parts of the intestine, though their favorite seat is the large intestine and especially the rectum. Smoler, who collected all of the cases in the literature, found numerous cases where they occurred in the large intestine and rectum, but only nine cases where they were located in the small intestine. Children from four to seven years of age seem to be chiefly affected.

Adenomata vary greatly in number, size, shape, and color. They may occur singly or, on the other hand, may be found throughout the intestinal tract, and number thousands. As a rule they range in size from that of a pea to that of a walnut, though they may be as large as an orange. They are sometimes sessile, but are usually pedunculated, are usually red and soft, sometimes firmer, have generally a smooth surface, but not infrequently are uneven or cauliflower-like.

They take their origin in the glands of Lieberkühn and in the duodenum from Brunner's glands, and their structure

resembles that of the normal mucosa, but the glands are longer and show a greater tendency to branch. It is sometimes hard to distinguish between benign adenomata and those becoming malignant, and it is impossible to rule out malignancy without a careful examination of all the specimens, especially their edges where they join the normal mucosa. Some say an adenoma is malignant when it extends through the submucosa, others when it extends through the muscularis mucosæ, and still others base their diagnosis on the character of the individual cells. In adenomata the protoplasm is clear, there is much mucus, and the nuclei are small and dark, whereas in cancer the protoplasm is finely granular, the mucus is less in amount, and the nuclei are large, contain much chromatin, and show active mitosis.

Clinical Symptoms of Adenomata.—These are in general somewhat varied, and depend chiefly on the size and location of the tumor. A small tumor in the rectum may cause more symptoms than a larger tumor in the small intestine, owing to the firmer nature of the large intestine content, and will therefore probably more frequently give rise to hemorrhage; moreover, blood from the small intestine may be so changed as not to be recognized in the fæces, though the anæmia of the patient may point to bleeding.

Subjective disturbances only appear when the bowel is more or less obstructed. In certain cases the cramps may be due to increased peristalsis or to a small intussusception which becomes reduced spontaneously, but when they are violent and continual, invagination, which is one of the most serious complications, has probably taken place. Many cases of invagination due to adenomata are chronic, and paroxysms of abdominal pain, occurring at intervals, which intervals tend to become shorter, point to invagination rather than to other forms of chronic obstruction. The presence of mucus and blood in the stools of an adult, with interval cramps and movable abdominal tumor, will often indicate an intussusception due to a benign tumor, and of these the adenomata, though rare, are the most frequent.

The nearer the polyps are to the lower end of the bowel,

the greater are the symptoms of irritation.   In most cases
with polyposis of the large intestine, there is a profuse diar-
rhœa, which may appear daily without pain or cramps.   The
chronicity of the illness even in these cases (stretching over
several years) without great debility in the patient is striking.
The diagnosis in cases of polyps of the rectum may be
facilitated by the tenesmus and sometimes by prolapsus of
the rectum or even of the tumor.

Etiology.—The etiology of intestinal adenomata has re-
mained obscure in spite of a great deal of work in this direc-
tion.   Inasmuch as we find a hyperplastic condition of the
intestinal mucosa accompanying certain ulcers and inflamma-
tions of the intestinal tract (apparently a reparative process),
some investigators have considered adenomata to be the re-
sult of such chronic inflammatory conditions.   Thus some
have dysentery to answer for the formation of adenomata,
especially since certain forms of polyps have been known to
appear after dysentery.

Nothnagel calls attention to the fact that they occur very
frequently in children, and König thinks they arise from a
congenital anlage.   Smoler advances the theory that the
presence of a congenital anlage plus a pathological hyperæmia,
due to inflammation, might account for the formation of
adenomata.   However, the real etiology of adenomata will
probably not be forthcoming until we have a better knowl-
edge of the origin of tumors in general.

Prognosis.—The prognosis of intestinal adenoma varies
so with the nature of each case that it seems impossible to
make any general statement in regard to it.   The prognosis
will be doubtful or unfavorable when the distribution of the
tumors is so extensive that radical operation is out of the
question, while single polyps in different parts of the in-
testine are of better prognostic import.   The prognosis, there-
fore, depends entirely upon the possibility of a radical opera-
tive therapy: it is good when the focus of disease can be
removed, bad in inoperable cases.   The chief complications
of adenomata are hemorrhage, invagination, and carcinomat-
ous degeneration.   The few cases reported seem to indicate

that the last is a rare complication and occurs perhaps more frequently in the sessile than in the pedunculated tumors.

Treatment.—Regarding the operation for polyps of the large and small intestine, there is not much to say. For single tumors, enterotomy and excision of the growth, after ligation of its pedicle, is recommended. For more extensive involvement, resection of the intestine may be advisable. For invagination, suitable surgery is demanded.

In the very extensive cases of polyposis of the large intestine and rectum the simple removal of the tumors from the rectum is of little value and can hardly be called a palliative operation, as the symptoms usually return so quickly. Extensive resections, with the production of a new anus, may be necessary, or it may be advisable to shunt out portions of the gut by lateral anastomosis or artificial anus. The use of local astringents and applications may be of service in inoperable cases.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, December 14, 1910.

The President, Dr. Ellsworth Eliot, Jr., in the Chair.

PERFORATED GASTRIC ULCER; PNEUMOCOCCUS SUBPHRENIC ABSCESS.

Dr. Walton Martin presented a woman, 38 years old, who was admitted to the Roosevelt Hospital on December 25, 1908. Her chief complaint was an agonizing pain in the upper abdomen. Just as she seated herself at her Christmas dinner she had felt a sudden stabbing pain in the epigastrium. This continued, and began to radiate to the left shoulder-blade and shoulder. In the course of an hour the abdominal pain became general, and of a " hot, acid " character. An ambulance had been called, and she was taken to the hospital.

The patient stated that for four months previous to this attack she had had marked soreness in the upper abdomen which radiated to the left side of the back. The pain had come on usually about half an hour after eating and persisted several hours. Her appetite had been good, but she had starved herself on account of the pain, and had lost much weight as a result. The pain had not seemed to be influenced much by the character of the food. There was no history of vomiting. For the past five weeks the stools had been very black. About ten months previous to her admission she had been operated on at the Gouverneur Hospital, a nephropexy and appendectomy having been performed. For sixteen years she had had indigestion; otherwise her past history was negative.

The physical examination on admission to the hospital had shown a rigid abdomen, very tender in the epigastrium, with tympany on percussion over the liver area. The pulse was 92; respirations, 40; temperature, 100.4°. A blood examination showed 18,200 leucocytes.

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At 3 A.M. on December 26, about eight hours after the onset of the pain, the abdomen was opened in the median line under ether anæsthesia. There were gas and gastric contents in the peritoneal cavity, and an indurated ulcer, with a round, punched-out perforation situated near the lesser curvature at the cardiac end of the stomach. The perforation was closed with Halsted sutures of linen, the abdomen was irrigated with normal salt solution until cleansed of gastric contents, and the abdomen closed without drainage. The patient's condition on the following day was satisfactory. On the eighth day the stitches were removed, the median laparotomy wound having healed by primary union.

On the thirteenth day there was a slight rise in temperature. This persisted with an irregular rise and fall. On the twenty-second day it was 102° in the afternoon, but the patient felt well and was gaining weight. On the thirty-ninth day there was still the irregular temperature; the leucocyte count showed 16,700 white cells, the patient had gained seven pounds in weight, and the abdomen was soft and not tender. On the fiftieth day there was dulness over the lower portion of the right chest with pain on breathing, and through a needle introduced in the midaxillary line between the ninth and tenth ribs about 10 c.c. of greenish yellow, foul-smelling pus was withdrawn. The next day, under ether anæsthesia, the ninth rib was resected, the diaphragm incised, and several ounces of pus evacuated from a subphrenic abscess. From that time on the patient made an uninterrupted convalescence, leaving the hospital on the 21st of February, 1909. She had continued in good health, and had gained 28 pounds.

Cultures taken from the pus from the subphrenic abscess showed a pure culture of pneumococci. It was interesting to note that in the monograph by A. Weichselbaum on the *Diplococcus pneumoniæ* in Kolle and Wasserman's "Handbuch der pathogenen Mikro-organismen," he calls attention to the fact that in the cases of pneumococcus peritonitis observed by him, as well as in the case reported by Bantis, there was a chronic gastric ulcer or a carcinomatous ulcer of the stomach, and he suggested that the pneumococcus had gained entrance to the peritoneum through the lesion in the stomach.

DR. CHARLES H. PECK said he had recently had a case of

subphrenic abscess in which the pus showed a pure culture of pneumococcus. This organism was also found in the blood, and the patient subsequently developed a right empyema, also of pneumococcic origin. Following this there was a patchy pneumonia, first on one side and then on the other, which proved fatal. This patient gave a distinct history of gall-stones, but the primary lesion, so far as could be made out, was the subphrenic abscess.

PARTIAL THYROIDECTOMY FOR EXOPHTHALMIC GOITRE.

Dr. Martin presented a negro woman, 23 years old, who was admitted to St. Luke's Hospital on March 21, 1910. Her weight on admission was 129 pounds, and she stated that she had lost about 50 pounds. There was marked exophthalmus, and the pulse ranged between 100 and 120. There was a fine tremor of the hand. In the neck was a moderately large, soft goitre. The patient suffered from attacks of cardiac palpitation, with flushing sensations. She said she felt miserable and nervous, and for a month past had been unable to work.

On March 26 the right half of the thyroid was removed under ether anæsthesia. The portion removed was about the size of an apple, soft, solid, vascular, and dark in color. Microscopic examinations showed some colloid areas, and in many places epithelial papillæ had grown out into the lumen of the follicles. The cells were more abundant than in ordinary goitre.

Immediately after the operation the patient's temperature was 104°, pulse 140. On the following day the afternoon temperature was 106°, pulse 160. On the third day the temperature had fallen to 103°, but the pulse was even more rapid, varying between 160 and 180. From that time on she began to improve, and left the hospital April 7, 1910. Since then she had gained 42 pounds in weight. Her present weight was about 170 pounds, and she was again able to earn her living by doing general housework. The exophthalmus was a little less pronounced; the pulse was about 100. The tremor of the hands had disappeared, but she still had occasional attacks of palpitation. The remaining portion of the thyroid had increased a little.

The improvement in the patient's nutrition, as shown by the gain in weight as the result of the partial thyroidectomy, was the striking feature of the case.

NEPHROTOMY FOR SUPPURATIVE NEPHRITIS
FOLLOWING LUMBAR URETEROSTOMY.

DR. MARTIN presented a negro woman, 44 years old, whom he had previously shown in October, 1909. He had operated on her at St. Luke's Hospital on Sept. 3, 1909, about one year and four months ago, removing the carcinomatous bladder and uterus, and implanting the ureters into the loins. In the discussion of the case at that time, the late Dr. Samuel Alexander brought up the point of the relative advantages and disadvantages of ureteral loin implantation and double nephrotomy, as advocated by Watson in a paper published in the ANNALS OF SURGERY, in 1905.

The patient was again brought before the Society to illustrate some of the points under discussion at that time. It was pointed out at the time she was shown that the drainage from the left ureter had been unsatisfactory at times, and that there was a tendency for the epithelium to close the ureteral orifice. On the right side there was no such tendency, the mucosa of the ureter having firmly established itself up to the level of the skin.

This tendency of the left ureter to close, with a resulting damming back of the urine, had continued, and from time to time last winter it was necessary to dilate the orifice of the ureter. On April 26, 1910, the flow of urine from the left ureter ceased, and the patient had a chill and vomited. Her temperature rose to above 104° and her pulse to 128. There was pain and tenderness over the left kidney. The passage of a small catheter into the orifice of the ureter withdrew but a few drops of pus. It was evident that there was a suppurative inflammation of the left kidney. The patient was accordingly again admitted to the hospital, and on April 29, 1910, a nephrotomy was performed and a tube introduced into the pelvis of the kidney. Several ounces of pus were evacuated. The patient made an uneventful recovery, and left the hospital May 14. Since then she had worn a small tube in the nephrotomy opening; this she removed daily, cleansed, and reinserted. Messrs. Stohlmann and Pfarre, the instrument makers, had fitted for her an ingenious apparatus which had greatly added to her comfort: on one side a cup with an inflated rubber

cushion was held in place by a spring band passing around the body like a truss spring, and on the other side a catheter passed through a hard rubber disk, and was held in place by the same spring. Both cup and catheter connected with a bladder which hung from her thigh.

The patient had continued in good health and had shown no evidences of a recurrence of the carcinoma. She had gained in weight and was able to do her housework. The patient had found the side on which the nephrotomy had been performed easier to care for than the side on which the ureter was implanted, the adjustment of the cup to collect the urine being difficult, and leakage occurring readily.

Dr. Martin said the case illustrated that a kidney draining freely, either through the ureter or directly from the pelvis through the kidney substance, was well tolerated by the patient, and he believed there was less danger from obstruction of the drainage following a nephrotomy than from the ureterostomy, but he thought that he should again be inclined, after a complete cystectomy, to do a loin transplantation of the ureters at the time of the cystectomy, as the shock and bleeding were less than in a nephrotomy, and later, if there was trouble with the drainage, as in this case, it would always be possible to perform a nephrotomy.

Dr. Charles L. Gibson said that, aside from the excellent kidney drainage and the ingenious apparatus by which the patient enjoyed comparative comfort after complete cystectomy, the case shown by Dr. Martin was a remarkable example of what could be accomplished in these advanced cases of carcinoma of the uterus involving the bladder. The operation was done in September, 1909, and the patient was apparently enjoying excellent health. The case should prove an incentive to others to do as radical an operation as possible in the face of these apparently hopeless conditions.

LIVER ABSCESS IN A CHILD.

Dr. Frank S. Mathews presented a boy, ten years old, who was admitted to St. Mary's Hospital for Children on July 26, 1910. He had been sick for ten days, with fever, vomiting, and pain in the right side. On admission his temperature was 105.8°; there was muscular twitching, and pain

and rigidity in the right loin and hypochondrium. The liver border was abnormally low, and the right kidney easily palpable.

Dr. Mathews said that, although abscess of the liver was not especially uncommon in the children of the tropics, it was exceedingly uncommon in New York, and in the case presented it was considered, in the absence of any knowledge of a portal infection, that it was more likely one of renal than liver infection. Consequently, an incision was made in the loin, into which the kidney seemed to prolapse; however, it was seen that the kidney was normal, and was simply pressed downward by a mass above and in front.

Through a right rectus incision the free edge of the liver was exposed, and, passing the hand underneath, a mass of adhesions was encountered. Upon separating these, a soft spot was felt on the under surface of the liver posteriorly, and with the finger, an abscess, about the size of a lemon and containing creamy, odorless pus, was evacuated. This contained the *Staphylococcus aureus.* The abscess was drained through both incisions.

Five days later the boy was again operated upon for acute intestinal obstruction. Through a McBurney incision a collapsed coil of gut was found and traced up to the rectus incision, where it was adherent and angulated. Recovery followed, but the boy ran an irregular temperature for two months. His convalescence was interrupted by abscesses of low virulence containing the *Staphylococcus aureus.* These abscesses developed about two weeks after the liver operation; they were numerous and deep-seated in the cellular tissues, and one abscess formed in the inner tuberosity of the left tibia and another in the inner malleolus of the same bone. These later formed sequestra which had been removed by operation. The shaft and medulla of the bone remained normal. The lower epiphysis of the right humerus became the focus for further trouble: there had been a thickening of the bone at that point, and the joint had been repeatedly aspirated of synovial fluid, but no pus had formed. The patient's general health was now good, and he seemed on the road to recovery.

Dr. Mathews said he had no suggestion to offer as to the portal of infection in this case, other than that it did not come from the appendix. At the time of the operation for intestinal

obstruction the appendix was inspected and found normal, and, furthermore, the pus from the liver abscess lacked the odor of most appendical abscesses. The case had been treated only by surgical drainage of the abscesses. Vaccines had not been employed, as the speaker thought it useless to give a few millions of dead cocci to a patient whose blood and tissues were filled with billions of live ones.

DR. L. W. HOTCHKISS said he had seen two cases of liver abscess in children, aged nine and twelve years, respectively. Both cases ended in recovery.

DR. A. V. MOSCHCOWITZ said that liver abscess was of common occurrence in Mt. Sinai Hospital. About five years ago the speaker said he tabulated over 100 such cases, and of that number there was only one case in a child. In that case, which was under the care of Dr. Arpad G. Gerster, the liver abscess was traced to a trauma. There was a distinct history of antecedent trauma, with probably hemorrhage and secondary infection.

DR. MATHEWS said there was no history of trauma in his case.

DR. MOSCHCOWITZ suggested that the liver abscess in this case was possibly hæmatogenous and an expression of a general infection from which the child was suffering. Perhaps the multiple abscesses which developed subsequently were due to metastases from the liver abscess, or perhaps they were all expressions of a general infection.

DR. MATHEWS said that all of the abscesses made their appearance within ten days after the original operation. Whether the source of the original abscess was through a blood infection or whether the subsequent abscesses resulted from the liver abscess he was unable to say.

DOUBLE ACUTE NON-TUBERCULOUS COXITIS.

DR. MATHEWS presented a girl, five years old, who was admitted to St. Mary's Hospital for Children on May 31, 1910. She had been well until two weeks before, and was sent to the hospital as a case of tuberculous coxitis. On admission, she was acutely ill, with a temperature of 104° and the physical signs of bronchitis. The movements of the right hip were painful: the hip was held in a flexed position in outward rota-

tion; however, there were no spasm, no night cries, and scarcely any limitation of movement. Under ether, nothing definite could be made out.

Three weeks later the left hip became similarly affected. The leucocytosis was high (thirty to forty thousand) for several weeks, with a differential count of about 85 per cent. of polymorphonuclears. Repeated Von Pirquet tests were negative for tuberculosis. Smears from the vagina were repeatedly negative for gonococcus.

Both thighs were maintained in an extension apparatus for three months. Removal of the weights from either leg would be followed within two days by a considerable rise in temperature. After five months she was allowed out of bed, and she has been walking with some difficulty since.

This child, apparently, Dr. Mathews said, had an acute, nontuberculous, non-gonorrhœal coxitis affecting both hips. The absence of flexion and spasm pointed to its primary synovial rather than bony origin. X-ray pictures at first showed normal bones; later, the acetabulum became excavated and deepened, and the femoral heads had been largely absorbed. New bone was now being formed around the joint. In spite of the deformity, the child was able to walk, and there was only moderate limitation of motion in flexion and rotation.

DR. ROYAL WHITMAN, discussing Dr. Mathews's case, said he was inclined to believe that the condition in the hip-joints was primary, as the temperature chart showed how perfectly the symptoms were under control when the joints were at rest. There was evidently a destructive process involving both joints, and he suggested that it might be well to place the limbs in abduction and relieve the pressure on the upper borders of acetabuli.

DR. MATHEWS asked Dr. Whitman if he saw any infections of this sort that were not tuberculous and which did not end in suppuration.

DR. WHITMAN replied that he had seen many cases of this type involving one joint, and that they were often mistaken for tuberculous disease. On this account he did not make a diagnosis of hip disease until the child had been under observation for a time, so that infections other than tuberculous might be eliminated.

BRAIN INJURY BY CONTRECOUP.

DR. MATHEWS presented a boy, eleven years old, who had always been well except for an injury four years ago. At that time a small piece of bone was said to have been removed over the left frontal eminence. The scar of that operation was apparent, and there was no doubt that there was a fracture of the left frontal bone.

Five days prior to his admission to St. Mary's Hospital for Children, four months ago, he fell into an areaway, a distance of three feet, striking the right zygoma on the tip of a sewing machine oil can. He was found unconscious a few minutes later by a physician, who sent him to a hospital. From then until his admission to St. Mary's he was said to have been in partial coma, with loss of sphincteric control.

Examination showed an old scar over the left frontal bone, and a small punctured wound over the right zygoma. There were no evidences of a fracture of the base or vault; no swelling nor ecchymoses. There was partial paralysis of the right side of the face, and complete paralysis of the right arm and leg. The tongue was deviated to the right. There was complete aphasia, the mouth was foul, and swallowing was difficult. The patient was excessively irritable, not unconscious, and followed movements with his eyes. His pulse for several days ranged between 50 and 60.

With all the symptoms pointing to a lesion of the left motor area, the question of operation arose, but action was postponed from day to day because of slight improvement, and although the slow pulse suggested compression, the blood-pressure was never recorded in excess of 110 mm.

When the boy left the hospital at the end of three weeks he was able to walk with difficulty; he understood perfectly, and could speak a few words. At present there was still slight facial palsy and some difference in the grasp of the two hands. The tongue protruded straight. For a time he was very emotional, but he was improving in that respect.

In this case, Dr. Mathews said, the trauma was upon the right zygoma, but there was no evidence of recent fracture. With the signs pointing to laceration or pressure on the left motor area, one was forced to think of adhesions about the site

of the injury of four years ago as concerned with his present symptoms. There had been no symptoms referable to his old injury in the intervening four years.

CONTROL OF HEMORRHAGE AFTER SUPRAPUBIC PROSTATECTOMY.

DR. F. KAMMERER presented a man, 72 years old, upon whom he had recently operated for prostatic hypertrophy. The case was shown to illustrate a point in the technic of the suprapubic operation. The speaker said he had been more favorably impressed with the latter operation during the past four years, and had practised it almost exclusively in preference to the perineal method, of which he had formerly been an adherent. The mortality had been and was still, perhaps, higher in the suprapubic cases, and this was, he thought, due in a great measure to the increased hemorrhage—not so much during as immediately after the operation. It was not an infrequent occurrence, after the enucleation of a large prostatic tumor from above, to have practically no hemorrhage at all from the wound surfaces of the bed of the prostate during operation, but it had happened to him in quite a number of cases, within the first hours following operation, to find that very alarming parenchymatous hemorrhage was going on after the patients had been returned to bed and placed in the horizontal position. In a number of cases he had been compelled to reopen the suprapubic wound, to pack the wound cavity of the prostate, and to exert digital pressure on the packing until the bleeding ceased. This had occurred in the patient he showed, who was operated on for an unusually large hypertrophy.

After repacking the bed of the prostate, very slight pressure of one finger would generally suffice to stop the oozing from the wound surfaces, and it had occurred to the speaker that this finger-pressure might be replaced by suture of part of the opening made during the enucleation of the prostate. To pack the cavity of the prostate with gauze, allowing the end of the tampon to protrude from the bladder above the symphysis, without any additional safeguard for retaining the tampon in position, was of little use. As soon as the tampon became soaked with blood and urine it would in part loosen up and fall into the bladder, and would not press against the wound surfaces, and

this would occur in a short time after the patient was returned to bed. In order to obviate this, the speaker had closed the irregular opening into the prostatic cavity in a transverse direction with three or four sutures of strong, plain catgut (non-chromicized), passing through the entire thickness of the bladder wall and the capsule of the enucleated prostate. The upper end of the opening was not sutured. Through this opening the tampon passed into the bladder and further through the suprapubic opening into the gauze dressing. The sutures were at first placed without tying them; the tampon was then introduced, and was of such size that when the sutures were tied, a certain amount of compression of the tampon would take place. A Freyer tube was put into the bladder above the projecting end of the tampon, and the wound was closed. The tube and the tampon were removed on the third day. There was no difficulty in withdrawing the tampon, as the catgut sutures in contact with the urine in the bladder evidently opened up in a day or two, thus practically re-establishing conditions that existed at the close of the enucleation of the prostate after the danger of post-operative hemorrhage had passed.

The speaker said he had employed this method in four cases of suprapubic prostatectomy with apparent success.

In reply to a question, Dr. Kammerer said he had thus far experienced no difficulty in introducing the sutures through the bladder wall and the capsule of the prostate. His incision into the bladder was about an inch or an inch and a half long but, of course, this incision could be stretched to almost any size necessary for removal of a large prostate. He had not resorted to the perineal operation as frequently lately, he said, because he had found that, technically, the suprapubic was simpler and possessed some advantages over the perineal method. When he did do the perineal operation, he always exposed the parts thoroughly by a curved incision in the perineum. He had never observed injury to the rectum or incontinence of urine, but had seen very troublesome perineal fistulæ after this method. One great advantage of the suprapubic method was the possibility of thorough inspection of the bladder without cystoscopy.

Dr. John F. Erdmann asked Dr. Kammerer whether in his experience the increased mortality of the suprapubic operation

was due to hemorrhage.   In the majority of cases, he thought, death was the result of renal insufficiency or to embolic conditions.   Personally, he could recall no case where death was due to hemorrhage.

Dr. Kammerer said he did not mean to leave the impression that these patients died from hemorrhage, but he did think that a severe hemorrhage after a suprapubic operation would be an additional unfavorable factor, especially when conditions cited by Dr. Erdmann existed.   In reply to a question as to whether he did the operation in two stages, Dr. Kammerer said he preferred to do it in one stage, unless there were evidences of severe infection.

Dr. Charles L. Gibson thought the suggestion of Dr. Kammerer very valuable in trying to improve the technic of the suprapubic operation.   It was certainly open to improvement.

In doing the perineal operation, he emphasized the importance of greater respect for the musculature of the parts, and since he had adopted the intra-urethral incision, his results had been much better than formerly.

AVULSION OF THE TUBERCLE OF THE TIBIA.

Dr. Charles L. Gibson presented a man, 40 years old, who fell and bruised his right knee.   There was slight pain, and an examination showed that an avulsion of the tubercle of the tibia had taken place.   The bone was exposed, the fragment restored to its proper position, and an ordinary steel nail driven in to keep it in place.   The patient remained in the hospital for twenty days, during which period the leg was immobilized. He made a good recovery, with perfect extension.   In reply to a question, Dr. Gibson said the operation was extracapsular, the joint not being opened.   The nail still remained *in situ.*

Dr. John F. Erdmann said that about two and a half months ago he was called to Staten Island to see a young man who, while attempting to strike a ball at tennis, slipped and tore off the tubercle of the tibia and about two-thirds of the internal tuberosity of the tibia.   The bone was exposed and the fragment sutured into place with kangaroo tendon.   He recalled one other case in an adult which was treated by pressure entirely, no open operation being done.

Dr. Benjamin T. Tilton said he had seen two cases of

avulsion of the tubercle of the tibia, one in a man, who four years previously had fractured the patella on the corresponding side, the fracture being sutured with wire. Two years later he fractured his opposite patella, which was sutured with chromic catgut. Subsequently he met with the same sort of an injury, producing this time an avulsion of the tubercle of the tibia; the fragment was sutured, with a very good result.

The second case was one where the tubercle was torn off and the fractured surface turned directly forwards, so that an open operation was absolutely indicated. The bone was exposed, the fragment turned back into its proper position, and sutured into place with chromic gut.

ACUTE HEMORRHAGIC PANCREATITIS.

DR. BENJAMIN T. TILTON showed this case. The patient was a Swedish woman, 29 years old, married, and the mother of one child. She was a moderate beer drinker, and denied venereal infection. Her general health had been good, excepting that she had had some " stomach trouble " for the past nine months. This had shown itself in the form of occasional attacks of vomiting after meals. The vomitus contained undigested food, mucus, and occasional blood. The last attack of vomiting occurred about two months ago, and the vomited material contained blood.

Thirty-six hours before Dr. Tilton saw the patient, in October, 1910, she experienced without warning a sudden, excruciating pain in the epigastrium. The pain was persistent, and finally extended over the entire abdomen and radiated to the chest behind the sternum. It was also felt intensely in the back. The pain was followed by vomiting and prostration, and the bowels were constipated. Her physician was compelled to give her several injections of morphine for the pain during the next twenty-four hours.

On admission to the hospital, the patient was in severe shock. The pulse was 150 and very weak, and the skin was cold and cyanosed. The rectal temperature was 103.4° and the respirations 50. The abdomen was markedly distended, tympanitic, rigid, and tender. The distention was most noticeable in the epigastrium. The abdominal symptoms were those of a general peritonitis. The blood count showed 14,000 leucocytes, with 87 per cent. of polynuclears.

Owing to the history of previous gastric disturbances, the sudden onset of the epigastric pain, and the intensity of the peritoneal symptoms, the diagnosis was made of perforated gastric ulcer and general peritonitis, although acute hemorrhagic pancreatitis was considered as a secondary possibility. On account of the extreme degree of collapse, a very unfavorable prognosis was given, but operation was advised and readily accepted.

Thirty-six hours after the onset of the symptoms, the abdomen was opened in the median line above the umbilicus, and a large amount of blood-stained fluid was encountered. This was present in greatest amount beneath the liver and in the lesser peritoneal sac. The intestines were markedly distended. Numerous areas of fat necrosis were found in the omental fat and on the peritoneal surface of the duodenum. The stomach was somewhat distended but otherwise normal. On exposing the pancreas, after raising the transverse colon, the former was found markedly swollen and abnormally soft. It was punctured with a pair of blunt scissors, and into the opening thus made a cigarette drain was introduced, and after washing out the bloody exudate, the abdomen was closed. The gall-bladder was somewhat distended, but no stones were felt within it or in the ducts.

The patient's condition was most critical after the operation, but she responded to free stimulation and the Murphy rectal irrigation, and subsequently made an uninterrupted recovery. Her temperature reached normal on the third day, and she has since been perfectly well.

The striking features of the case, Dr. Tilton said, apart from the unexpected outcome, were the sudden stormy onset, the persistence of very intense pain, and the close resemblance of the later symptoms to general peritonitis. Immense relief followed the simple removal of the peritoneal exudate, which gave rise to great tension. Drainage of the pancreas was apparently not a factor in the recovery, as the dressings were scarcely soiled, and the opening closed as soon as the drainage was removed.

Dr. CHARLES H. PECK referred to a case of acute pancreatitis recently under his care, in which the symptoms were those of a rather obscure abdominal condition. Upon opening

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the abdomen he found a cholecystitis, with marked pancreatic involvement. The gall-bladder was drained, but the pancreas was left undisturbed. As the patient continued to have some temperature, drainage was continued rather longer than was usual in cholecystostomy. After about a fortnight, a large, dense swelling was made out in the upper abdomen, and a second operation revealed a pancreatic cyst containing about 1500 c.c. of a clear, watery fluid. This had evidently developed in the interim between the two operations. Upon examination, this fluid was found to contain large quantities of proteolytic ferment. This was the first time, Dr. Peck said, that he had seen a pancreatic cyst develop under his eye. The amount of pancreatic tissue destroyed in this case must have been very considerable, judging from what could be seen and what came away with the drainage. Still, the patient seemed to have sufficient pancreatic tissue left to sustain life. The urine was found to contain sugar.

DR. HOTCHKISS said he had under his care at present a case similar to the one presented by Dr. Tilton. In his case, the patient gave a history of an acute seizure, with symptoms dating back about four days, and which was diagnosed as a small perforation of the stomach or duodenum. The patient, an alcoholic, apparently in good health, had gone to bed after eating a very heavy meal. He woke up during the night with severe epigastric pain, got up, took some whiskey, and vomited, and was brought to the hospital on the following day. Three days later he developed a swelling in the epigastrium, and was transferred to the surgical ward. Upon incision through the upper right rectus, the entire gastrohepatic omentum was found to be a mass of fat necrosis. The lesser peritoneal cavity was drained of blood-stained fluid and particles of necrotic tissue, and the man improved to a certain extent, but as he still continued to run a temperature, and as the disease had continued sufficiently long to have resulted in a good deal of fat necrosis, a secondary incision was made in the left loin for the purpose of additional drainage, and lumps of tissue were discharged. After the drainage was freed the patient was still profoundly anæmic, and free discharge persisted, but was diminishing.

In this case, which was still under observation, the disease seemed to be confined to the body and splenic end of the

pancreas, a considerable part of which had apparently necrosed. The patient was slowly improving. Dr. Hotchkiss said the only case of true hemorrhagic pancreatitis he had ever seen had proved fatal within two or three days, and he asked Dr. Tilton whether he regarded his case as one of true acute hemorrhagic pancreatitis, according to the usual classification of that disease.

DR. TILTON replied that he had based his diagnosis upon the character of the hemorrhagic fluid that he had found, especially in the lesser sac, as well as upon the extensive fat necrosis. The pancreas itself was soft and large, especially the head of the organ. The case was operated on at such an early stage that actual necrosis of the pancreas had not yet developed. Drainage did not result in bringing out any necrotic tissue.

Dr. Tilton thought it was not very unusual to have these cases recover, providing they were operated on sufficiently early. An early operation, too, prevented further necrosis.

DR. JOHN F. ERDMANN said he had seen four cases of hemorrhagic pancreatitis within the year. In two of them, upon which he operated, recovery took place. In the other two, where no operation was done, the diagnosis was made by the attending physicians and himself, and confirmed by autopsy. In both of the latter cases the patients were in a moribund condition, contraindicating operation. The patients were males, ranging from 45 to 50 years, and in all of them there was a history of gall-stones.

Dr. Erdmann said he had thus far reported ten cases of pancreatitis, seven of the hemorrhagic type; of the latter, five recovered after operation.

DR. MOSCHCOWITZ said that in operating for acute pancreatitis, he now tried to introduce his drainage through the gastrohepatic omentum, which he thought was preferable to the gastrocolic omentum, as it gave better access to the pancreas and afforded more efficient drainage. It was usually assumed, the speaker said, that a cholecystostomy was beneficial in these cases. About three years ago he saw a stout woman, who was suffering from what was supposed to be cholecystitis. At all events, her symptoms raised no suspicion of acute pancreatitis. When Dr. Moschcowitz first saw her she refused operation, but three days later, when he saw her again, she gave a distinct picture of acute pancreatitis. She was sent to the hospital,

and upon opening the abdomen he found the pancreas much
enlarged, with numerous areas of fat necrosis. The gall-bladder
was filled with calculi. He did a cholecystostomy, the gall-
bladder was drained, and the patient, apparently, was on the
road to complete recovery. On the day preceding her intended
discharge he was hastily sent for, and found the woman in a
state of collapse. Upon examination, a large mass was made out
in the upper abdomen. He made a diagnosis of acute hemor-
rhage of the pancreas, which was verified upon operation.

DR. JOHN F. ERDMANN said that in one of his cases, the
output of urine for twenty-four hours was submitted to Dr.
Frederic E. Sondern for examination, and he reported that there
was no Cammidge reaction. Subsequently, however, it was
positive. In this case the pancreas showed fat necrosis plus
hemorrhagic necrosis.

DR. GEORGE WOOLSEY said that from his own experience, as
well as from what he had learned from the literature, it
seemed to him that very many of these cases of acute pan-
creatitis could be saved, providing they were operated on suffi-
ciently early. He was also inclined to believe that in the very
acute cases a cholecystostomy had better be postponed until a
later date, as these patients were usually very sick and could
not well bear the strain of an additional operation. Incision
and drainage would relieve a large number of these cases.
With this treatment necrosis of the pancreas seldom occurs.

DR. MARTIN said that in a case which he operated on at
a very early stage, about two years ago, he split the pancreas
and instituted drainage. In spite of the early operation, necrosis
occurred, and the entire pancreas sloughed away. The patient
died in about three weeks.

DR. PECK said he had an experience similar to that recounted
by Dr. Martin. The case was one of acute pancreatitis which
he operated on within eight hours after its sudden onset. The
patient died of necrosis.

CELLULITIS OF THE SPACE OF RETZIUS.

DR. A. V. MOSCHCOWITZ said that at the last meeting of the
Society, under the title of extensive pericystitis he had presented
a man, 64 years old, who had suffered for the past seven years
from symptoms of prostatic enlargement, and who, about four

weeks ago, had an attack of obstruction of urine for the relief of which he was aspirated by his physician. Immediately after this aspiration, the patient complained of severe abdominal pain; he became distended, vomited, and symptoms of a mild degree of ileus developed. All of these symptoms were overcome by medication, and the patient left the hospital within a few days.

He returned to the hospital on November 20, 1910, complaining of pain in the lower half of the abdomen, and examination showed a very firm, painful, and tender mass extending from the symphysis pubis to within two inches of the umbilicus. In general, this mass had somewhat the shape of a pregnant uterus, and it could be made out that it was intramural and not intraperitoneal.

After showing this case, Dr. Moschcowitz said, he poulticed the mass, and when fluctuation became apparent he made a small incision into it and evacuated six ounces of pus. It could be demonstrated with the finger that the mass was extraperitoneal. It was evidently a cellulitis of the space of Retzius, and probably resulted from an infection carried by the needle puncture which had been done to relieve the distended bladder.

DISINFECTION OF THE SKIN BY TINCTURE OF IODINE.

DR. CHARLES L. GIBSON read a paper with the above title, for which see page 106.

DR. JOHN A. HARTWELL said he had used this method of disinfection over the scalp, with very good results.

DR. KAMMERER said that for the past year he had been in the habit of giving the patient a bath on the evening preceding operation. No further preparation of the field of operation was necessary. On the operating table the skin where the incision was to be made was rubbed with ether and then painted with a single coating of the tincture of iodine. His results had been excellent.

A METHOD FOR THE PREPARATION OF CATGUT.

DR. A. V. MOSCHCOWITZ read a paper with the above title, for which see page 110.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held November 7, 1910.

The President, Dr. Robert G. Le Conte, in the Chair.

THE TECHNIC OF MEDIAN PERINEAL PROSTATECTOMY.

Dr. Samuel Alexander, of New York, by invitation, read a paper with the above title, for which see page 390.

THE TECHNIC OF SUPRAPUBIC PROSTATECTOMY.

Dr. John B. Deaver, with reference to the technic of suprapubic prostatectomy, said that:

The technic of suprapubic prostatectomy commences in reality with the selection of the patient for operation. A patient, irrespective of age, good general health, good kidneys (in that they functionate normally, that is to say, excrete the normal amount of urine from the stand-point of the patient's age), with a large soft prostate, one that upon palpation with the finger in the rectum gives a sensation as if it were movable in its capsule, is a suitable case for operation.

He laid great stress upon the condition of the kidneys in the selection of his patients, and then preparation for operation. The patient must pass the normal amount of urine for a man at his time of life, considering that he must have more or less contraction of the kidneys, therefore the amount of urine must be larger than he had passed earlier in life. The speaker also laid stress upon the percentage of urea. He cared little if there is albumin, so long as it is not much, or if there are casts. He also considered carefully the condition of the bladder, its capacity, its tonicity, the amount of residual urine, the degree of cystitis if any, and the presence or not of a stone.

A cystoscopic examination should be made in certain cases, which will determine the condition of the bladder, the vesical aspect of the prostate, ureteral orifices, etc.

A bad cystitis should receive serious attention and is best handled by a retention catheter and bladder washings with boric acid, permanganate of potash, argyrol, etc. Culture of the urine to determine the micro-organism is essentially important. A few cases will not tolerate a permanent catheter, but will not be made worse by passing a catheter twice daily when the bladder can be irrigated. This will enable the operator to determine the class of cases in which he can close the bladder wound and that of the abdominal wall up to the drainage tube and thus prevent infection of the wound, which so often is a disagreeable factor; in this wise convalescence is hastened. A severe cystitis at the time of operation favors epididymitis; so does passing of sounds too soon after operation.

In the presence of high arterial tension as shown by the pulse, which is also often irregular, and the blood-pressure instrument, a course of nitroglycerine, the drinking freely of water, and in some cases proctoclysis are necessary to bring the case to a successful termination after operation.

The surgeon's anxiety and greatest responsibility only commence, as in many surgical operations, after the operation. Proper nursing at the hands of a gentle, kind, diplomatic, and experienced female nurse is important.

The operative technic involves the following elements:

Anæsthetic.—Ether is the only anæsthetic used in the speaker's clinic and he has no reason to think of using any other. Ether has always been perfectly satisfactory if properly given.

The anæsthetic may be given with the patient in the Trendelenburg position. The patient having been anæsthetized, an English catheter is passed into the bladder, followed by the introduction of two ounces of boracic or normal salt solution, catheter clamped with hæmostat.

Incision. Opening of bladder. Retractors. Inspection of bladder. Piece of gauze in the fundus of the bladder. Circular incision round internal meatus over prostate. Enucleation. Hemorrhage. Drainage.

Massage to coapt walls of bed of prostate. Small piece of gauze in perineal space to be removed in two days. Gauze in bed of prostate to control bleeding. Sterile rabbit serum if coagulation time is very slow. Can save prostatic urethra frequently.

Before recovery from anæsthetic, hypodermoclysis followed by proctoclysis.

After-treatment.—Avoid passing instruments through the urethra for three weeks, then simply to see if channel is unobstructed.

Stricture: Irregular margin of roof of bed of the prostate may be the cause of subsequent trouble. Two cases in speaker's experience requiring correction. Suspensory to be worn during convalescence.

After drainage tube is removed, wash out through suprapubic opening until it becomes too small to pass it, then introduction of simply the end of the nozzle of the tube into the external meatus and wash out bladder. This is sometimes required while the suprapubic wound is still large enough to wash out the bladder through this avenue, as when there are pus or shreds in the urine this affords means of thorough cleansing of the base of the bladder. The latter can be done through a soft catheter passed through the urethra into the bladder, but should not be used if avoidable, for fear of disturbing the healing process going on in the prostatic bed. Dr. Deaver said he had seen prevesical abscess, for which it may be necessary to incise the perineum.

DR. EDWARD MARTIN said that Dr. Alexander's work has received such universal acceptance that a discussion of his findings amounts to little more than a congratulatory appreciation. He had completely summarized the principle of enucleation of the prostate in the sentence " find the line of cleavage." That done, the operation is simple. He, however, had to confess a lack of confidence in surely striking that line when guided only by the sense of touch—he preferred to look in by a wider opening than is afforded by the median perineal route. Shock is, however, proportionate rather to the roughness and long continuance of manipulation than to the size of the wound. In men over fifty also comes the possibility of sexual incapacity being dependent on perineal trauma. The perineal route is more frequently followed by this disability than is the suprapubic. He had seen the same result follow the perineal operation for stone, and, in fact, almost any perineal operation, and believed that this impotence is in no wise due to damage to ducts, but is the result of extensive perineal trauma.

With regard to Dr. Deaver's remarks, it is perfectly true that the Trendelenburg position with proper illumination brings the operative field within the range of vision. He had devised a little light for these operations that goes into the bladder with a lateral retractor, so that until free bleeding occurs the base of the bladder and the urethra and urethral orifices are plainly seen. It is stated that Freyer always enters through the anterior commissure, he believing the line of cleavage to be most marked at this point.

DR. THOMAS R. NEILSON said that he was a firm believer in the selection of cases for operation. Some bad results can be prevented by being cautious as to those who are subjected to operation. The condition of the kidney, as well as of the bladder, should as nearly as possible be known, and any needed preliminary treatment given. After operation it is wise to pass sounds. This applies to either form of prostatectomy. It can do no harm, and may do much good.

Drainage of the prevesical space is a detail in the completion of the suprapubic operation which should not be omitted. In every suprapubic operation a small gauze drain should be placed there to prevent infection which might otherwise occur.

DR. HARRY DEAVER said that he had had some difficulty in controlling hemorrhage in these perineal operations, and he thought in suprapubic operations the hemorrhage to be more easily controlled. Cases may go on nicely for four or five days, then may be purged very freely and after that hemorrhage may occur. The bowels should be kept as quiet as possible until the vessels are entirely healed.

DR. SAMUEL ALEXANDER (in closing) said, with regard to the line of cleavage, that this point applies just as much in the suprapubic operation as in the perineal. This line of cleavage is clearer at the upper commissure than anywhere else, and any surgeon who studies the part of the prostate left as well as the part removed, will have no difficulty in reaching the same conclusion.

He did not claim any priority for any operative procedure, but simply emphasized the anatomical principles which underlie prostatectomy, whether this be done through the suprapubic or through the median perineal route. He agreed with Dr. Deaver that it is a matter of very little moment whether a part of the prostate is left behind or it is all taken out.

With regard to Dr. Deaver's remark that he had made no mention of bacteriology, he supposed was meant whether there exists a septic condition in the bladder or in the kidneys. He made no special preparation of his patient because the operation, as it is done, gives the very best treatment for septic conditions of the bladder that can be secured. If the bladder is opened and drained just as an abscess is opened, the best possible chance is given to recover itself; it does not matter whether the infection is streptococcic, staphylococcic, or gonorrhœal. The lowest possible level of access to the bladder is secured through the technic employed by him. The bladder is drained and then nature takes care of it.

Is it necessary to look into a bladder in order to see a prostatectomy? Many surgeons operate for appendicitis through a very small opening, separating adhesions with great skill, delivering the appendix, and then tying off, and have their patients recover. By practice and study of the prostate any one may become so proficient that he does not do a "blind" operation. He will be able to feel the line of cleavage just as he feels where the adhesions go in a laparotomy, can recognize the condition of the prostate just as that of the appendix, gall-bladder, or any other organ, and it is purely a matter of whether a man will take the pains to train himself as to which operation he will do. Of course, if one does not study the large number of museum specimens which are going to waste, if one will not take the trouble to dissect them intelligently, one will continue to do the open operation, but if one does study them one will learn so much more in regard to the prostate that the line of cleavage will become as simple as the Golden Rule.

In determining where to begin enucleation, cut the lateral lobe with scissors and feel down for the line of cleavage. The statement that the base of the prostatic tumors is covered by mucous membrane is not in accordance with anatomical facts, as can be shown by any longitudinal section of a prostate.

The advantage of the perineal operation is simply in the general surgical principle that in removing a growth from any place it should be gotten out by the shortest possible route, with the least damage to tissue and least danger of hemorrhage, and in this case the median perineal is the route to follow. The only reason it is not universally adopted is because men have

not taken the pains to study the pathological anatomy of the parts.

In regard to the bad results, Dr. Alexander did not feel any fear in reference to stricture as he did the operation. It is not his custom to pass any sound through the urethra until several weeks afterward. He then passed a sound in order to see that the urethra is all right. In this operation the mucous membrane is entirely preserved around and outside the urethral orifice. It is not necessary to preserve the urethra, but to prevent stricture it is necessary to preserve a perfect smooth mucous membrane about the urethra, and that is always the case in a properly performed perineal urethrotomy.

BOOK REVIEWS.

A Treatise on Orthopædic Surgery. By Royal Whitman, M.D., New York. Fourth edition. Lea and Febiger, Philadelphia and New York, 1910.

Orthopædic surgery has departed somewhat from its ancient practice, and now aims at the prevention of deformity as well as the treatment. In order to accomplish this, it has been necessary to study the causes of diseases which produce deformity, and direct the treatment to their prevention. Thus tuberculosis of joints is now recognized in its early stage, and healing often secured before deforming disease has developed. The next step to be hoped for is a social one, in which the industrial and economic conditions, lying at the root of such diseases, shall be corrected.

This book of Dr. Whitman's, since its first edition, has been regarded as a standard exposition of orthopædic surgery. The last edition brings it up to date. There are many noteworthy features. The text is full but not redundant. The description of the physical examination for tuberculosis of the spine may be cited as an admirable example of the surgical literature which should be found in a treatise of this sort. Under the head of diagnosis of this disease we find the following true and pathetic statement: " If a careful physical examination were made in all suspicious cases, by one at all familiar with the ordinary symptoms of Pott's disease, the field for differential diagnosis would be small indeed; but it would appear that such examinations are not made usually by the physician who is first consulted. One may learn, for example, that the child has been circumcised because of pain about the genitals, or because of weakness of the limbs, supposed to be due to ' reflex irritation '; or if the patient is an adult, that he has been treated for sciatica, rheumatism, or strain, long after the deformity, even, would have been apparent had the back been inspected."

Differential diagnosis of this disease is well presented. The method of applying plaster-of-Paris jackets is presented so that one gets a practical clinical picture. In cases of emergency, it is advised that retropharyngeal abscesses may be opened by an incision in the middle line of the pharynx, but preferably it should be opened through the side of the neck. The author

uses the word "costotransversectomy" to designate resection of the joint between the rib and transverse process. We are of the opinion that the learned author would not defend this bad word.

Though describing and recommending the more conservative measures, the impression is given that the author is more inclined to the incision of tuberculous abscess of the spine than is the present practice among surgeons. Dr. Gould, at least, would object to the omission of eye-strain as a cause of curvature.

Truslow is quoted as stating that investigation shows that in a large proportion of cases of curvature the patients had led sedentary lives and did not enjoy exercise. The exercises and manipulations for correction are fully described. Teschner's exercises are quoted from the ANNALS OF SURGERY. The classic treatment of kyphosis and lordosis is given.

The discussion of cervical ribs is brief, but, perhaps, as full as a work of this scope should give. Wolff's law, concerning changes in the form and function of bones, is fully described.

The essentials of Bier's hyperæmic treatment are given, but tuberculin is not spoken of. The description of the treatment of infections by means of vaccines is inadequate for a work published in 1910. It seems also to the reviewer that the treatment of non-tuberculous diseases of joints might have been given somewhat more in detail. If hæmophilia is worthy of being described, some word concerning its modern treatment might have been introduced.

That America was the cradle of orthopædic surgery is contradicted by the references to Thomas's early work. When American surgeons generally believed that motion was necessary in the treatment of joint diseases in order to prevent ankylosis, Thomas, of Liverpool, showed that immobilization was the best treatment for hip disease. Thomas is given full credit for his important work.

Lorenz is freely alluded to in the discussion of congenital dislocation of the hip. The description of the pathology and etiology of coxa vara is succinct. The diagnosis and treatment are admirable. The advantages of cuneiform osteotomy are well presented. The illustrations, showing the advantage of treating fracture of the neck of the femur by extreme abduction, are convincing.

Flexner's work upon anterior poliomyelitis is referred to.

Perhaps more of the distinctly medical side of this disease is given than one would expect to find in a book on orthopædic surgery. The treatment of the paralyses and the paralytic sequelæ is good. Hoffa's operation for paralysis of the deltoid, by transplantation of the trapezius, is given.

Anterior metatarsalgia is well described. Morton's operation, the author says, is as a rule successful, but in the majority of cases it is unnecessary. The treatment of ingrown toe-nail is confined to a single operation, that of Webb, by means of silver wire placed under and around the nail. This method evidently has proved sufficient in the hands of the author.

The sane discussion of shoes, which this work presents, might wisely be read by every layman. Much social good would accrue if it could be distributed widely as a tract.

The treatment of club-foot by stretching, so warmly advocated and so forcibly applied by Lorenz, is well presented. It is here that the German and Austrian surgeons have excelled. Great good is accomplished whenever the orthopædist declares his appreciation of the susceptibility of the soft tissues to the influence of stretching. "*Man hat in der Orthopädie viel zu wenig mit der Elasticität der Theile gerechnet.*"

<div align="right">J. P. WARBASSE.</div>

DISEASES OF THE COLON. By P. LOCKHART MUMMERY, F.R.C.S. 322 pages, illustrated. John Wright & Sons, Ltd., 1910.

This work, founded on the Jacksonian essay for 1909, is timely because of the greater frequency of pathologic conditions of the large intestine which have developed during the past few years, consequent in some measure, certainly, to the introduction of the modern diet of prepared foods, and to an increase in the number of people employed in sedentary occupations; both factors inhibiting most markedly the stimuli to peristalsis, and thus giving rise to the most potent factor in the etiology of disturbances of the large intestine. Such a book is the more welcome because it serves to classify and correlate the very rapid strides which the diagnoses and treatment of these conditions have taken.

It is difficult to classify the book, as it falls far short of being encyclopædic in its scope, and, on the other hand, is not monographic in its detail. Throughout is to be noted a very meagre bibliography, and but seldom is mention made of ex-

tensive consideration by contemporary authors of the subject in hand.   The American literature suffers particularly in this respect, although the work of Cannon and others is deservedly mentioned and accredited under the chapter of physiology.

After the rather brief chapters on physiology, bacteriology, etc., the author considers the congenital abnormalities of the colon, chiefly dilatation, and introduces the operation of appendicostomy for its relief, quoting a successful case; this certainly deserves consideration.

This is succeeded by a good presentation of volvulus of the colon; but the following chapter on adhesions and kinking of the colon is rather defective in the consideration of their treatment.

Chapter IX takes up inadequately the X-ray diagnosis of colonic malpositions, and no mention is made at all of the stenoses consequent to carcinomata, or the presence of diverticula. In considering the subject of pericolitis, the presence of diverticula is mentioned as its etiologic factor in some cases.   The confused ideas of the author regarding the etiology in cases of cancer occurring in conjunction with diverticula is noticed on page 195.   Reference to contemporaneous American literature would, we feel, have served to eliminate the rather indefinite position taken on this question.

We are glad to note the author's ideas on the treatment of chronic constipation, particularly inasmuch as they are not in accord with those writers who regard the colon as of small importance to the bodily economy.   The author deprecates the operation for its relief as practised by some, namely, that of resection of the colon with its consequent 33 per cent. mortality. Doubtless there are a few cases in which this procedure may seem indicated, but they must be extremely rare, and the reviewer fully agrees that the more simple one of appendicostomy should at least be given a thorough trial.

The chapters dealing with tuberculosis, simple stricture, embolism of the mesocolic vessels, cancer, colotomy, and the various other operations on the colon, while good to a degree, are, on the other hand, disappointing in the very noticeable deficit of details.

The book is admirably written, but it cannot be considered in any way a complete résumé of our present-day knowledge in this department of medicine and surgery.

APPLIED ANATOMY—THE CONSTRUCTION OF THE HUMAN BODY CONSIDERED IN RELATION TO ITS FUNCTIONS, DISEASES, AND INJURIES. By GWILYM G. DAVIS, Associate Professor of Applied Anatomy in the University of Pennsylvania. With six hundred and thirty illustrations, mostly from original dissections and many in color by Erwin F. Faber. Philadelphia and London: J. B. Lippincott Company.

The author presents for consideration a volume of six hundred and thirty pages with six hundred and thirty illustrations.

The subject is treated regionally, according to the usual anatomic divisions. The morphology and function of each part is briefly described and followed by a consideration of the surface anatomy.

Next the author considers the various affections of the part, correlating anatomical and clinical facts in such a practical way that the applied anatomical facts are clothed with a new and vital interest.

The value of the work is further increased by indicating the anatomical principles involved in the diagnosis and treatment of the affected part. The mechanism of dislocations and their reduction is fully described; the rationale of the principal operative procedures is given, and the classical ligations, amputations, and excisions receive a consideration perhaps in excess of their relative importance.

The illustrations in this work are of unusual excellence, and for the most part original. Many of the dissections have been reproduced in color. All are pertinent and show commendable care in selection and execution.

Anatomically, clinically and artistically this work is thoroughly satisfactory.

WILLIAM FRANCIS CAMPBELL.